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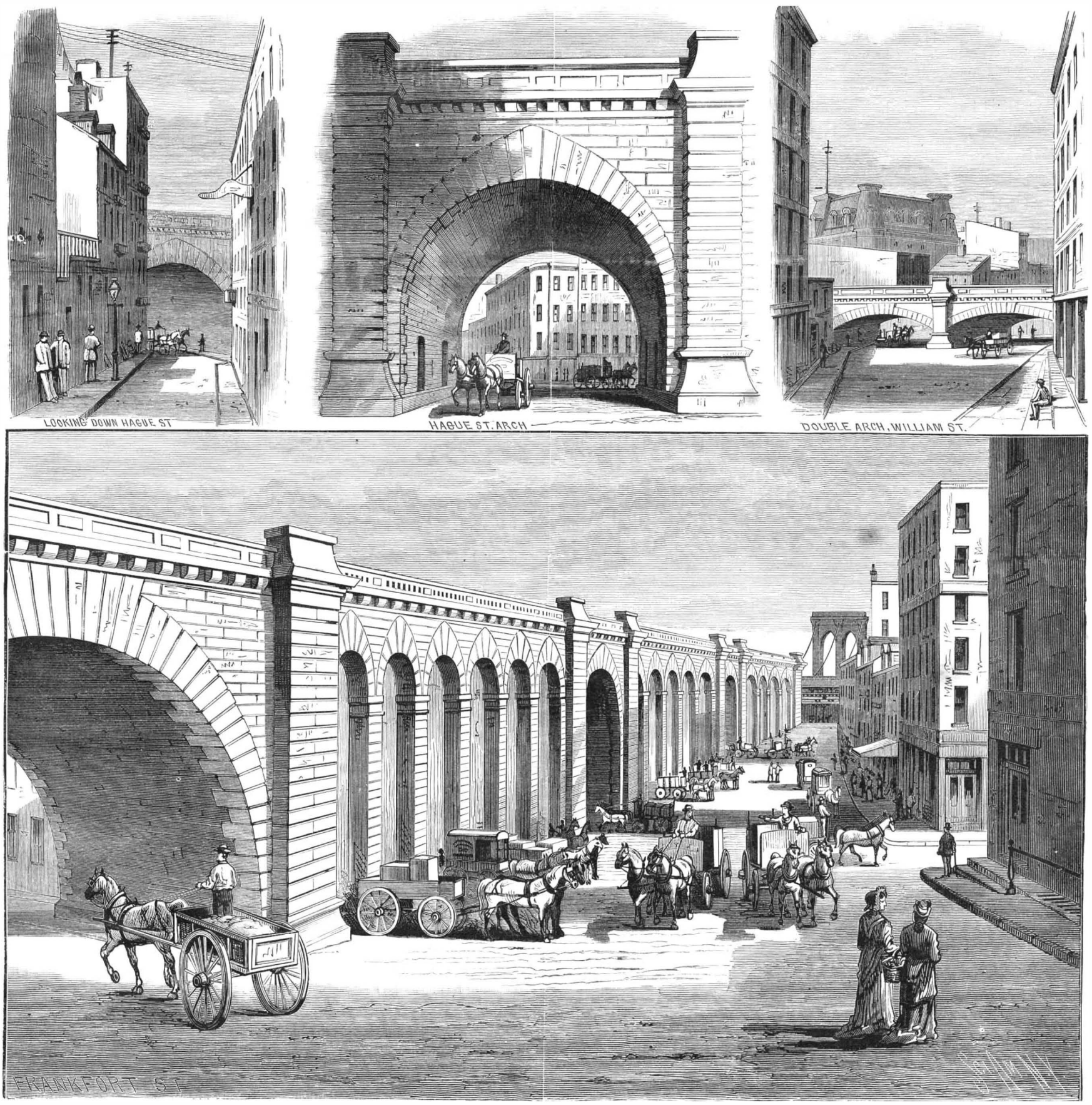
PROGRESS OF THE BROOKLYN BRIDGE.

The several views of the New York approach to the East River Bridge, shown below, will give a better idea of the magnitude and present condition of this portion of the great work than any amount of verbal description.

At this writing but one small arch of masonry lacks completion. The only other gap in the magnificent viaduct is at Franklin Square, where Pearl street is to be spanned by an iron bridge, and it is probable that the contract for this portion of the work will have been given out before these lines are printed.

The construction of the superstructure of the main bridge has been delayed, owing to the grave difficulties encountered in producing and shaping the steel. The trusses called for larger bars of steel than had ever been produced in this country, and special machinery had to be constructed for the purpose. And when this had been done it was found that much greater engine power than had been anticipated was required for the rolling of the bars. Another source of delay was the different behavior of steel from iron while in process of shaping, necessitating repeated alteration of the rolls before some of the more difficult forms and sizes could be exactly and uniformly produced. All these engineering and mechanical difficulties have now been surmounted; all the forms and sizes that the structure will require have been made, and are now being delivered more rapidly than the material can be used. It is expected that a large stock of material can be accumulated in the yards by the piers during the winter months, so that as soon as the weather will permit the erection of the superstructure of the bridge can be pushed with the utmost speed.

The great cables and other supporting elements of the structure are complete and ready for the attachment of the superstructure with its suspenders and stays. For some distance on each side of the towers the suspenders are already in place; and it is probable that during the remaining winter months several forty-foot sections of the truss work will be swung into position landward and riverward from each of the towers; but it will scarcely be prudent to push the work further until the stormy season is at an end. The erection of that portion of the superstructure within the towers will be begun the first week in January.



NEW YORK APPROACH TO EAST RIVER BRIDGE.

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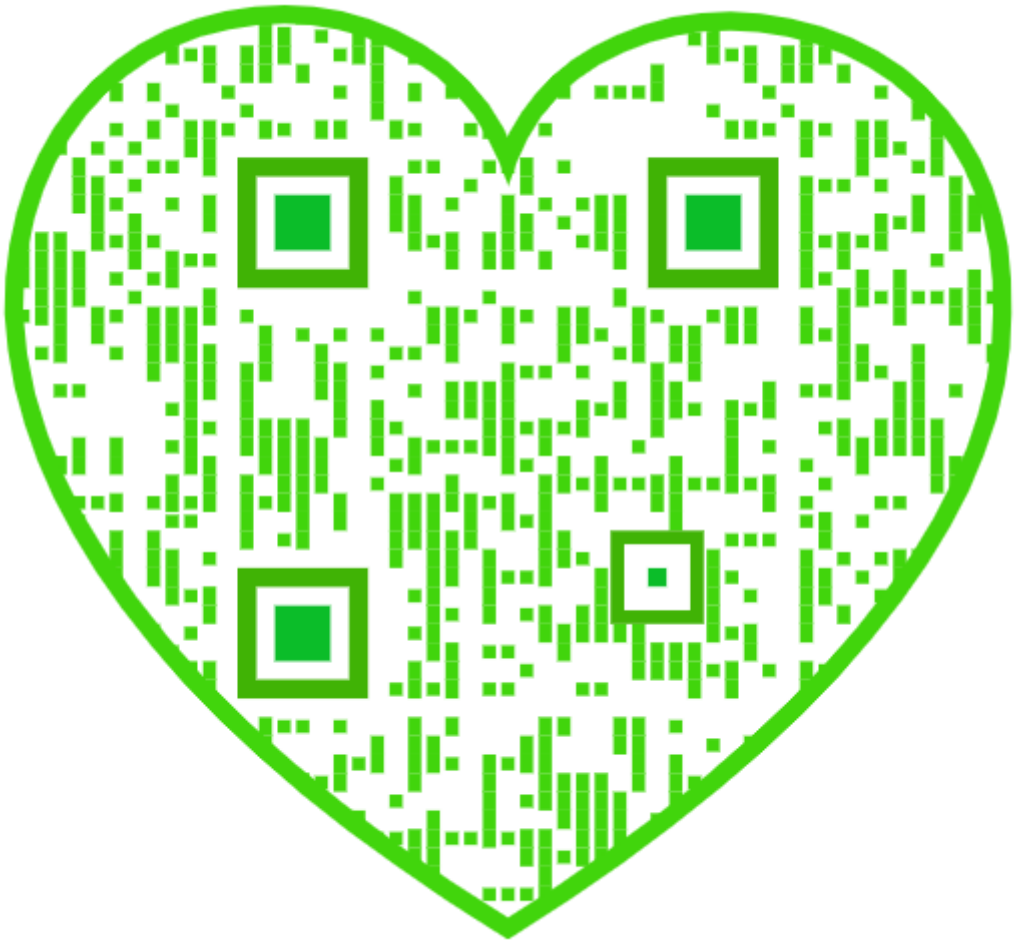

By the beginning of spring, unless some altogether unexpected disaster occurs, here or at the steel works, there will be in readiness a sufficient amount of material to allow the work to be pushed with the utmost rapidity. Four gangs of men will be employed at each tower, two building shoreward and two toward the center of the river. In this way the increasing strains upon the towers will be equalized, and the lengthening structures on either side kept properly balanced. The material will be raised at the towers, and conveyed to the extremities of the working on temporary railways.

With the facilities which are at command for handling the material, and the large number of men that can be employed, the engineers are confident that the five thousand tons of metal which the superstructure will require can be put in place during the next twelve months.

The timber for the wooden portion of the roadway is now being prepared by a process of creosoting. No official action has yet been taken with regard to the means to be employed in handling passengers and freight; it is probable that a cable system, similar to that in use in San Francisco. will be adopted.

The Rose of Jericho.

At the last meeting of the Royal Botanic Society, Professor Bentley called attention to the peculiar properties of the so-called Rose of Jericho, pointing out that during the dry season it becomes coiled up into a ball, and is blown about the dry, sandy deserts of Egypt and Syria for many months; but at the first shower of rain its leaves expand, and it becomes apparently revivified as if its life were renewed. If placed in water, or in moist sand or earth, it opens out in a similar manner; and it is so sensitive to moisture that it indicates by similar changes in its leaves the presence or absence of moisture in the atmosphere, and thus acts as a natural vegetable hygrometer, in the same way as a bunch of seaweed will become hard and dry in fine weather, and soft and leathery in damp or rainy weather. In this case it is the salt which is present in the leaves that is acted on; and it is quite possible that a similar explanation of the phenomenon in the case of the Rose of Jericho might be found if the plant were subjected to careful analysis. As the first Rose of Jericho was brought to England as long ago as 1597, it is time that the cause of its curious properties was discovered. The rose has been called a vegetable barometer; but this is evidently incorrect, as it is influenced by the hygrometric and not the barometric state of the atmosphere.

The Steam Engine Governor.

The great importance of strong and efficient steam engine governor connections is illustrated by the fatal accident which took place Nov. 18, at Messrs. Howard and Bullough's iron works, Accrington, Eng. It appeared at the inquest that one of the bevel wheels which drove the governor had broken, and the consequence was that the engine "ran away." The men in the grinding shop ran out of the place, and they were followed by those in the smiths' shop, and from all parts of the works. Five grindstones flew to pieces, and the fragments were hurled through the roof and fell on to the smiths' shop, demolishing a portion of that roof. One piece, weighing about six cwt., flew half the height of the chimney and alighted on an anvil, behind which a smith was at work. The man who was killed was sharpening an axe, and did not make off when the other men did. Some very narrow escapes took place. The engine ran for three minutes after the steam had been shut off, and turned all the shafting. The engine tender was at dinner at the time the accident occurred.

Hot Sand a Good Bed Fellow.

The comfort which a hot water bag or even a hot brick may afford a person on retiring, chilled, is very great, and beyond this, the use of some such warmth-producing appliance is useful as a health preservative and restorative. But one of the most convenient articles to be used as a bed warmer and in a sick room is a sand bag. Get some clean, fine sand, dry it thoroughly in a kettle on the stove, make a bag about eight inches square of flannel, fill it with the dry sand, sew the opening carefully together, and cover the bag with cotton or linen cloth. This will prevent the sand from sifting out and will also enable you to heat the bag quickly by placing it in the oven, or on the top of the stove. After once using this you will never again attempt to warm the feet or hands of a sick person with a bottle of hot water or a brick. The sand holds the heat a long time, and the bag can be tucked up to the back without hurting the invalid. It is a good plan to make two or three of the bags and keep them ready for use.

Telegraphic Progress in China.

The U. S. Consul-General at Shanghai, China, informs the State Department at Washington that the Emperor of China has given permission for the construction of a telegraph line from Shanghai to Tientsin, a distance of 1,200 miles. The route will be from Shanghai to Chinkiang, thence along the line of the Grand Canal to Tientsin. A short line of about 70 miles will also probably be constructed by the Viceroy at Nankin to connect the capital of his province with the main one at Chinkiang. The work of setting the poles and laying the wire will be begun early next spring. It is estimated that the work will cost $500,000.

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PROGRESS OF THE BRUSH SYSTEM OF ELECTRIC LIGHTING.

The ancient saw anent the share of milk obtained by the still suckling seems to be pretty well borne out in the progress of the Brush system of electric lighting. A dozen systems, so-called, have made more noise and have attracted more newspaper attention; but while they are for the most part still "promising," the Brush system has been quietly taking possession of the field. How far this is due to the superior business management of the company controlling the Brush patent it is impossible to say; the indications are, however, that the remarkable success of the Brush system is mainly due to the practical genius of Mr. Brush in meeting the requirements of outdoor or large room lighting with an efficient generator, and a lamp which is so simple in construction, so automatically regular in action, and so easy to keep in order, that practical business men can afford to use it. It is perhaps the least ornamental in appearance of all lamps, but it gives the light required, and calls for comparatively little care. On the score of economy the users of the lamp profess to be well satisfied; and the rapid and largely extended adoption of the system, abroad as well as at home, would seem to justify the favorable judgment which those who have tried the lamp have freely expressed with regard to its practical value.

The latest list of prominent users of the Brush light embraces twenty-five rolling mills, iron and steel works, machine shops, car works, wire works, and the like; twenty saw mills, paper mills, oil works, printing houses, and other factories and manufacturing establishments; twenty woolen, cotton, linen, and silk factories, several of them employing over a hundred lights each; a dozen mines, smelting works, etc.; more than a dozen large wholesale and retail stores, using from six to sixty-four lights; a dozen public parks, docks, summer resorts, and the like, including a mile and a half of river front and docks at Montreal; circuses, colleges, hotels, steamers; and large numbers of city lights in San Francisco, St. Louis, Chicago, Cleveland, Detroit, Grand Rapids, and other cities, besides New York and Brooklyn, where a hundred or more lights are already in use. The contracts of the company in San Francisco called for the erection of about a thousand lamps by the beginning of the current year. Wabash, Indiana, claims the credit of being the first large town to adopt the electric lamp for general illumination, four Brush lights, of 3,000 candle power each, on the court house dome, sufficing for the outdoor needs of the entire town of 10,000 inhabitants.

The company formed in London to introduce the Brush light there have already placed two hundred lights in various parts of the city, and have ordered from Cleveland nearly as many more, contracts having been signed for the lighting of the Houses of Parliament, Charing Cross Station, Ludgate Hill Station, Blackfriars' Bridge, St. Paul's Churchyard, and other conspicuous places. Even the extremely conservative British Admiralty has taken kindly to the Yankee invention, 432 lights having been purchased for the use of the Royal Navy. Mr. Brush is now making a 40-light machine (80,000 candles) designed to throw the entire current into one huge lamp, which has been ordered for the British torpedo service. The carbons for this artificial sun will be as large as a man's arm, and the light, when directed by a projector of corresponding size, will of itself be a formidable weapon of defense. With a proper system of curtains it will be possible to flash upon an approaching enemy a sudden glare of light that will be little less than blinding.

A less imposing but more admirable application of this light, and one that is being rapidly adopted, is in connection with locomotive headlights. The generator is operated by a small engine taking steam from the boiler and placed opposite the air compressors of the Westinghouse brakes. By attaching the reflector to the forward truck the light may be thrown so as to illuminate the track ahead even when rounding curves. It is obvious that the same machine which supplies the headlight will also furnish a current for illuminating the cars.

Wherever the electric light has been brought fairly into competition with gas for lighting large rooms or open spaces, it has given a good account of itself in comparisons of cost. In very many cases, however, any comparison with gas is out of the question. With gas it is simply impossible to do certain kinds of work at night, or to do it as rapidly and well as by daylight. With the electric light night production is brought up to the level of day production. The gain of one night's increased production will often pay the cost of electric lighting for months. Practical business men are not slow to appreciate advantages of this sort. The question with them is not how much will the electric light cost, but can the light be depended on for steady, uniform, certain operation, without requiring too much expert attention? The ability of the Brush lamps to meet such practical requirements would seem to be the secret of its substantial progress.

ON AIDS TO HEARING.

Until within a few years the old-fashioned ear trumpet was the sole reliance of deaf persons as an aid to hearing, but since the invention of the telephone much more attention has been given to the subject of sound, its production, and distribution. Especially after the public announcement of the misnamed microphone and its ability to enable a person to hear a fly walk at a distance of a mile or more, was the attention directed to devices for the benefit of deaf persons,

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and there at once arose a crop of various species of *phones*, such as the *audiphone*, the *dentiphone*, and so forth.

They have one and all failed in their purpose, being quite inefficient compared with the ear trumpet. The reasons for the failures will be plain to one who considers what the physical conditions must necessarily be.

Whenever a sound is produced in free air, the latter immediately diffuses it in every direction, the sound wave assuming a spherical form and traveling outward with a velocity, generally upward, of eleven hundred feet in a second.

Now, the strength of the sound, or in other words its energy, is proportional to the square of the amplitude of vibration, and as diffusion goes on the energy is proportionally spread, so that at a double distance the intensity is but one-fourth the original intensity. Secondly, whenever a sound wave strikes upon any surface whatever it is reflected in part as an echo and in part is absorbed; that is the body presenting the surface is itself made to vibrate, and generally the loss by reflection is as much as one-half of the energy.

Now, what is specially wanted is to bring the vibrations with their utmost energy into the ear so as to shake the appropriate bones there. In a normal ear there is energy enough in the small part of the spherical sound wave that reaches the membrana tympani to make hearing easy; but if for some such reason as a thickened membrane more energy is required to make it vibrate properly, the way to do it is either to bring the source of sound nearer to the ear, so that it shall receive the largest possible part of the spherical wave, which will be when the source of sound, say the mouth, is immediately at the conch of the ear—nothing will likely surpass that for intensity—or else, by some special device, prevent the sound from spreading in the air, and directing the wave with all its intensity into the ear, as though the mouth were at the ear.

In the light of these principles how is it with the audiphone? A more or less elastic surface is held by its edges between the teeth and hand, and some tension given to it by curvature. Of sound vibrations made in its neighborhood it receives its proportionate part of the spherical wave, of which, certainly, half will be reflected, another part will be received by the hand and lost, while the remainder will be distributed, first, to the teeth, and from them to the whole skeleton, the ear getting but a small part. Still, as the ear, even a defective one, is a marvelously sensitive organ, there may be energy enough in the vibrations that are made in this abnormal and roundabout way to enable one to hear what is said.

Any device for getting sound vibrations to the ear by the way of the bones must necessarily have these diffusive defects. None of them can bring to the ear the sound vibrations with their maximum amplitude. The ear trumpet comes nearer to the necessary conditions than anything that can be proposed; for, first, if the bell be spoken into there is no appreciable loss by reflection nor from scattering, that is, the spherical wave is not formed as it is in free air; and, second, the tube opens near to the membrana tympani, and the whole energy of the sound is spent on that.

If, however, the passage to the tympanic membrane be nearly or quite closed by the thickening of the mucous membrane, then the ear trumpet will be nearly or quite useless, as it would also be in the case of a tympanic membrane that was either too thick to respond or too flabby. In the former case nothing would be heard, and in the latter articulation would be very defective; but in general, when these abnormal conditions are not present and one cannot hear with an ear trumpet, other devices will be of no service, for the trouble is with the auditory nerve, and the judgment of a skillful aurist should be obtained in any case. When the nerve is unimpared and the passage to the tympanic membrane is closed, it is possible for one to get some help from some form of the dentiphone; but for reasons already given one must hope but for small service from any of them. In most cases of deafness the ear trumpet is much the most efficient.

Many persons, however, are only slightly deaf, who need some aid, to whom an ear trumpet would be highly objectionable, and who would be glad of some substitute. For such persons it is well to know that the common string telephone answers well.

Theoretically it fulfills the conditions. The transmitter prevents the formation of the spherical wave to any extent, the string prevents the scattering, while the receiver fits close to the ear, and it may have an appropriate tube to enter the tympanum, in which case there is really but a very little loss. The common ones of the market costing but ten cents a pair answer every purpose. The thread need not be but two or three feet long, and the whole may be carried in the pocket. I have personally experimented with these upon deaf persons, and am assured by them that they are much helped by their use. One may talk with such a deaf person with ordinary loudness and be easily understood, when, without it, what is said must be said so loud as to be heard in distant parts of the house. A year or two ago I tried to induce a manufacturer in Boston to make for the market some of these instruments specially adapted to the wants of deaf persons, but the reply was that if made so small they could ask but a small price for them, and the demand was not enough to make it a profitable investment; but larger ones (for a show of cost) were made for business purposes, and five dollars a pair was asked. But, as said before, cheap ones are just as efficient and much more portable.

HARVEST FIGURES.

A good many curious calculations have been made in connection with the enormous crops of wheat produced by the Dalrymple farm in Dakota. A correspondent of the Chicago *Inter-Ocean* has been indulging in some new ones relative to the last harvest. From the speed of the harvester and the length of the cutting-bar he calculated that there would be 900 bundles to the acre, or seventy-five shooks of twelve bundles each. As there were 18,000 acres in the field the shooks numbered 1,350,000, and the bundles 16,200,000. Allowing thirty inches of wire to the bundle, over 7,670 miles of wire were needed for binding the crop—almost enough to reach through the earth.

PROFESSOR GAMGEE'S ICE MACHINE.

A press dispatch from Washington, dated December 22, gives a very amusing report of an exhibition of an ice machine at the Navy Yard the day before. The report states that "the great novelty of the apparatus consists in the utilizing of heat which all others waste, and the liquefaction of ammonia by expansion. Almost immediately after the machine was started a temperature of nearly zero was obtained. Chief Engineer B. F. Isherwood, in an interview with Professor Gamgee, recognized the correctness of the principle, which had now been demonstrated to be sound by actual test. The heat of southern climes, the Professor maintains, will henceforth prove no obstacle to cheap ice making, since where there is most heat, by his new system, there is most available energy wherewith to drive the machine. The consumption of coal is thus reduced to a minimum. This fact was recognized by the Board of Naval Engineers, who reported favorably on Prof. Gamgee's plans for the refrigerating ship."

Heretofore it has been held to be established, both in theory and in practice, that it costs more to freeze warm water than cold water. Given water at 32° Fah., a certain amount of heat has to be withdrawn before the water will congeal. To withdraw this heat artificially costs money, both for power and for water to carry off the heat withdrawn. With every degree of heat which the water shows above 32° Fah., more heat must obviously be withdrawn, and a larger volume of waste water will be required to carry it away before the water operated on can be frozen. Thus, even if the waste water costs nothing, the increased power required in freezing the warmer water must increase by so much the cost of the ice. This is as certain and plain as the familiar fact that it costs more to draw a load up hill than on a level. The report claims that where the heat is greatest there is the most available energy for ice making, which is equivalent to saying that he can use the load on his wagon to propel the wagon up hill.

How Far Does the Sound of Cannon Travel?

To the Editor of the Scientific American:

The battle of Bunker Hill was fought June 17, 1775. The sound of the cannon used in the engagement was distinctly heard by persons on the Deerfield River on the east side of Hoosick Mountain, where now is the town of Charlemont, Mass., the distance being one hundred and twenty miles. This is asserted in "The Memoirs of Capt. Lemuel Roberts," a rare work, printed at Bennington, Vt., 1809. Capt. Roberts was an officer in the army of the revolution. He says: "We were surprised at the hearing of a heavy cannonade from a great distance, which proved to be the battle of Bunker Hill." P. 27.

On July 29, 1812, a naval engagement, with a cannonade lasting an hour and a half, occurred between the United States Flotilla of Delaware, Lieut. Samuel Angus commanding, and some British ships that were in the bay. The conflict transpired near Cape May, not far from a place called Crows Shoals. The firing of the cannon was heard by many persons at Washington city, the distance of which from the scene of action in a direct line is one hundred and twenty miles. This is recorded as "A Curious Fact" in Vol. 2, No. 9, page 40, of *The War*, published weekly at New York, 1812–13.

These cases are well authenticated. The cannon could not have been so large as those now in use. Are there similar instances on record? And how far distant can the report of the heaviest cannon be heard? D. T. TAYLOR.

Hyde Park, Mass.

ELECTRO-METALLURGY.

COPPER DEPOSITS.

Where it is intended to simply coat or plate another metal or alloy, the electro-deposit of copper is usually obtained by the decomposition of a double salt, such as the cyanide of copper and potassium. This process is adapted to most metals, and affords a fine uniform deposit. The following is a good bath of this description:

Water (soft)	1 gall.
Acetate of copper (cryst.)	3½ oz.
Carbonate of soda (cryst.)	3½ "
Bisulphite of soda	3 "
Cyanide of potassium (pure)	7½ "

Moisten the copper salt with water to form a paste (otherwise it is apt to float on the liquid); stir in next the carbonate of soda with a little more water, then the bisulphite, and finally the cyanide with the rest of the water. When solution is complete the liquid should be colorless. If not, add cyanide until it is.

The bath may be employed hot or cold, and requires a moderately strong circuit of electricity. A copper plate forms the anode, and it should expose surface enough to supply the loss of copper—at least a surface equal to that of the work. It must be removed when the bath is not in use.

If the liquid becomes colored, more cyanide must be added.

Large pieces are generally kept hanging motionless in the bath while the plating is in progress; small articles are moved about as much as possible, especially if the bath is warm.

The formula for the bath given above requires pure cyanide of potassium, and where the commercial article, which is often very impure, is used instead considerable allowance must be made. The following formulæ require a cyanide containing 70 to 75 per cent (a good average) of pure potassium cyanide:

COLD BATH FOR IRON AND STEEL.

Acetate of copper	3 oz
Carbonate of soda	6½ "
Bisulphite of soda	3½ "
Cyanide of potassium	3¼ "
Water	1 gall.
Aqua ammonia	2½ fl. oz.

Prepare as before.

WARM BATH.

Acetate of copper	3½ oz.
Carbonate of soda	3½ "
Bisulphite of soda	1½ "
Cyanide of potassium	4½ "
Water	1 gall.
Aqua ammonia	1½ fl. oz.

HOT OR COLD BATH FOR TIN, CAST IRON, OR LARGE ZINC PIECES.

Acetate of copper	12½ oz.
Bisulphite of soda	10 "
Cyanide of potassium	18 "
Water	5½ gall.
Ammonia (aqua)	7 fl. oz.

For small articles of zinc, which are coppered in a perforated ladle and in nearly boiling baths:

Acetate of copper	16 oz.
Bisulphite of soda	3½ "
Cyanide of potassium	25 "
Aqua ammonia	5½ "
Water	4 to 5½ galls.

In the preparation of these baths the salts are all dissolved together, except the copper acetate and ammonia, which are added after dissolving together in a small quantity of the water.

The deep blue color of the ammonio-copper solution should entirely disappear on mixing it with the other solution; otherwise, it becomes necessary to add more cyanide.

The cold bath is put into well joined tanks of oak or fir wood, coated inside with gutta percha or asphaltum (genuine). The vertical sides are also covered with sheets of copper, all connected with the last carbon or copper of the battery by a stout copper wire with well-cleaned ends, the other pole of the battery being in similar connection with a stout brass rod extending the length of the tank (without any point of contact with the anodes), and from which the work is suspended by hooks or trusses in the bath.

With a thin deposit the coating is sufficiently bright to be considered finished after being rinsed and dried, but if the operation is more protracted the deposit has a dead luster on account of its thickness, and if a bright luster is desired it is necessary to use the scratch brush.

The hot baths are usually put into stoneware vessels heated by a water or steam bath, or into an enameled cast iron kettle placed directly over a fire. The vessels are lined inside with copper, the edges of the vessels being varnished or support a wooden ring upon which rests a brass circle connected with the zinc pole of the battery. The objects to be electroplated are suspended from this ring.

The hot process it more rapid than the cold, and is especially adapted to those articles which are difficult to cleanse. The articles are kept in continual agitation, which permits of the employment of a strong current of electricity. Small articles of zinc are placed in a perforated stoneware or enameled ladle, at the bottom of which is attached a copper wire which is wound up around the handle and connected with the zinc pole of the battery. It is sufficient that one of the small articles touches the wire for all to be affected by the current, as they are in contact with each other. The ladle must be continually agitated, so as to change the points of contact of the objects. What has been said in regard to strength of battery, in the article on electro-brass plating, will apply here.

COPPER DEPOSITS BY DIPPING.

This is seldom practiced except upon iron, as deposits thus obtained are generally wanting in lasting qualities, since, from the thinness of the coating, the iron is but imperfectly protected from atmospheric influences. If the iron is dipped in a solution of—

Sulphate of copper	3½ oz.
Sulphuric acid	3½ "
Water	1 to 2 galls.,

it becomes covered with a coating of pure copper, having a certain adhesion; but should it remain there a few minutes the deposit becomes thick and muddy, and does not stand any rubbing. Small articles, such as pins, hooks, and nails, are thus coppered by tumbling them for a few moments in sand, bran, or sawdust impregnated with the above solution diluted with three or four volumes of water.

ELECTRIC EXHIBITION, PARIS.—It is proposed to hold an International Exhibition and Congress at Paris in 1881.

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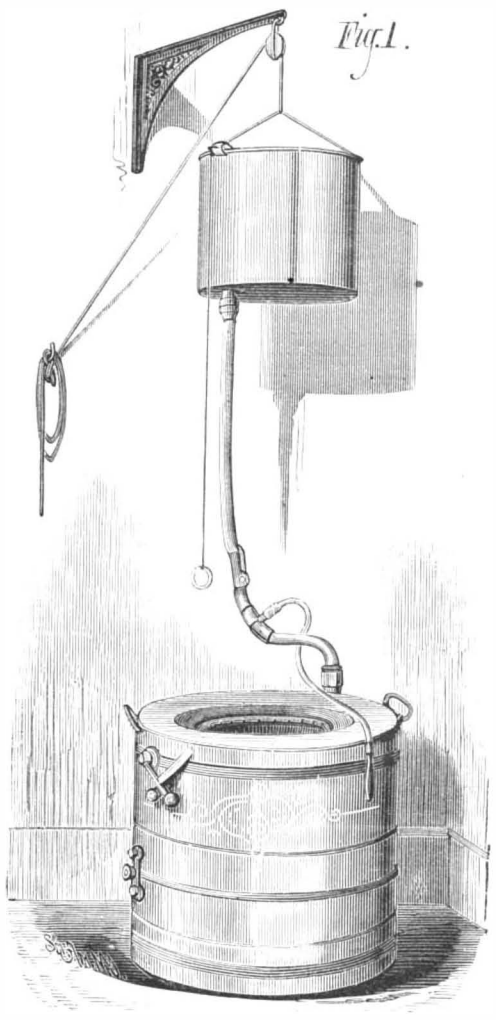
PORTABLE FOUNTAIN WATER CLOSET.

The article shown in the annexed engraving is one that should form a part of the furniture of every house, and is especially valuable for invalids and the aged. It is also a great convenience for persons in health, particularly in the country, in cold and inclement weather and at night; and as a sanitary provision it will prove beneficial in several ways. It will permit of a prompt obedience to nature's laws, and thus save both health and the cost of medicines and medical attendance. It is perfectly air tight, and is consequently odorless. It is readily moved from one room to another, and if it becomes necessary to pack it for storage or for transportation, all of the parts may be placed in its lower casing.

The inventor has arranged the fountain in connection with the lower portion of the casing, so that it may be used as a shower bath, a perforated nozzle being provided for this purpose.

The device is contrived so that it may be concealed in



PORTABLE FOUNTAIN WATER CLOSET.

an ottoman or easy chair. The bowl, A, is furnished with a circular perforated pipe at the top, through which water is admitted from the flexible pipe connected with the fountain. The valve, B, at the lower end of the bowl is operated by the lever, C, which when raised first drops the valve, then swings it to one side. When this lever is depressed it first brings the valve under the bowl and then raises it up against the soft rubber packing at the bottom of the bowl. The joint between the bowl and valve is practically air tight, and the water always left in the bowl seals the joint perfectly. All other joints in the apparatus are sealed with flexible rubber packing rings.

PORTABLE FOUNTAIN WATER CLOSET.

In connection with the fountain an enema jet is provided, which can be used without the slightest inconvenience.

We are informed that a number of these closets have been in use in cottages at watering places and in other summer resorts, giving great satisfaction. They also attracted a great deal of attention at the late Fair of the American Institute, and were awarded a diploma.

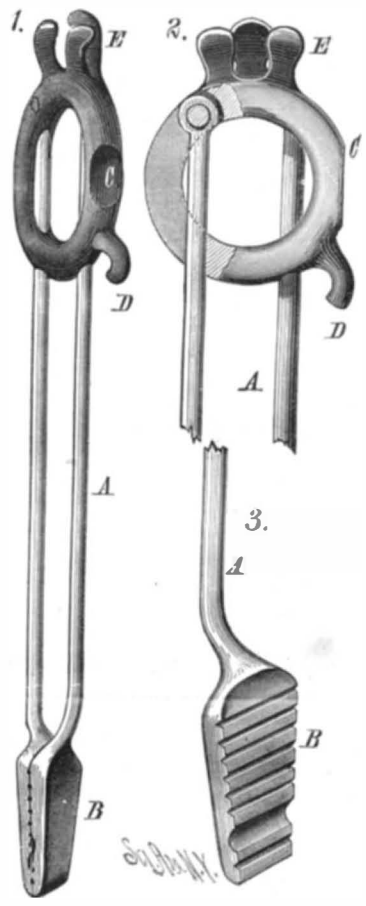
This invention was recently patented, and is being manufactured at No. 243 Water street, by the Portable Fountain Water Closet Company, M. J. B. McQuillin, manager. The post-office address of the company is Box 2279, New York city.

STEAMBOATS FOR SOUTH AMERICAN RIVERS.

Messrs. Yarrow & Co., Poplar, the well known builders of swift torpedo boats, have been recently building two shallow draught stern-wheel steamers, intended for the conveyance of the mails on the river Magdalena, for the Government of the United States of Colombia. These vessels are put together temporarily in the yard at Poplar, and are then taken to pieces and shipped out to their destination. Each vessel is 130 feet long, has 28 feet breadth of beam, and draws 16 inches of water when without cargo and having the steam up, but 26 inches with 90 tons of cargo aboard. The hull is built of steel varying from three-sixteenths inch to one-fourth inch in thickness. It is divided into eighteen water-tight compartments, so as to localize any damage through being penetrated by rocks or snags. All the forward part of the vessel below water is treble riveted, as an extra precaution. The boiler, which is of the locomotive type, is placed on the main deck forward, and the engines on the main deck aft, and thus easily accessible. To obtain the greatest economy of fuel the engines are made on the compound surface condensing system, and for the sake of lightness all the working parts are of steel. They are probably the first compound engines ever fitted to stern-wheel steamers. The cylinders lie one at each side of the vessel, and work direct with a connecting rod on cranks at each end of the axle of the wheel. They are expected to develop 350 to 400 horse power, and have some peculiar arrangements to adapt them for the service. The vessels have what may be termed spoon bows; the sterns retain their full breadth, rounding up gradually from the flat bottom to above the water line, and thence upward square. There are three rudders at the stern before the wheels, the center one being a balanced rudder and the other two of ordinary form, the shaft or rudder head extending up from the center one, and the side rudders moving parallel to the middle rudder by means of a connecting link. In the bow, before the boiler, there is fitted a steam capstan for heaving or working the vessel, if necessary, past a rapid. Alongside the boiler, in connection with the fan engine, is to be fitted a circular saw for cutting up the wood fuel. A speed of between fifteen and sixteen miles an hour, at least, on a continuous run, is anticipated from these boats. This, considering the extremely light draught of water, will be a very remarkable result.

IMPROVED TONGS.

The engraving shows an improved tongs designed expressly for household use, and containing several useful implements in one. A ring, forming the head of the tongs, receives the fixed and the movable leg, and has three projections, E, at the top forming a plate lifter, a hook, D, for lifting stove covers and pots and kettles, and a flat roughened, C, forming a hammer face. The jaws of the tongs



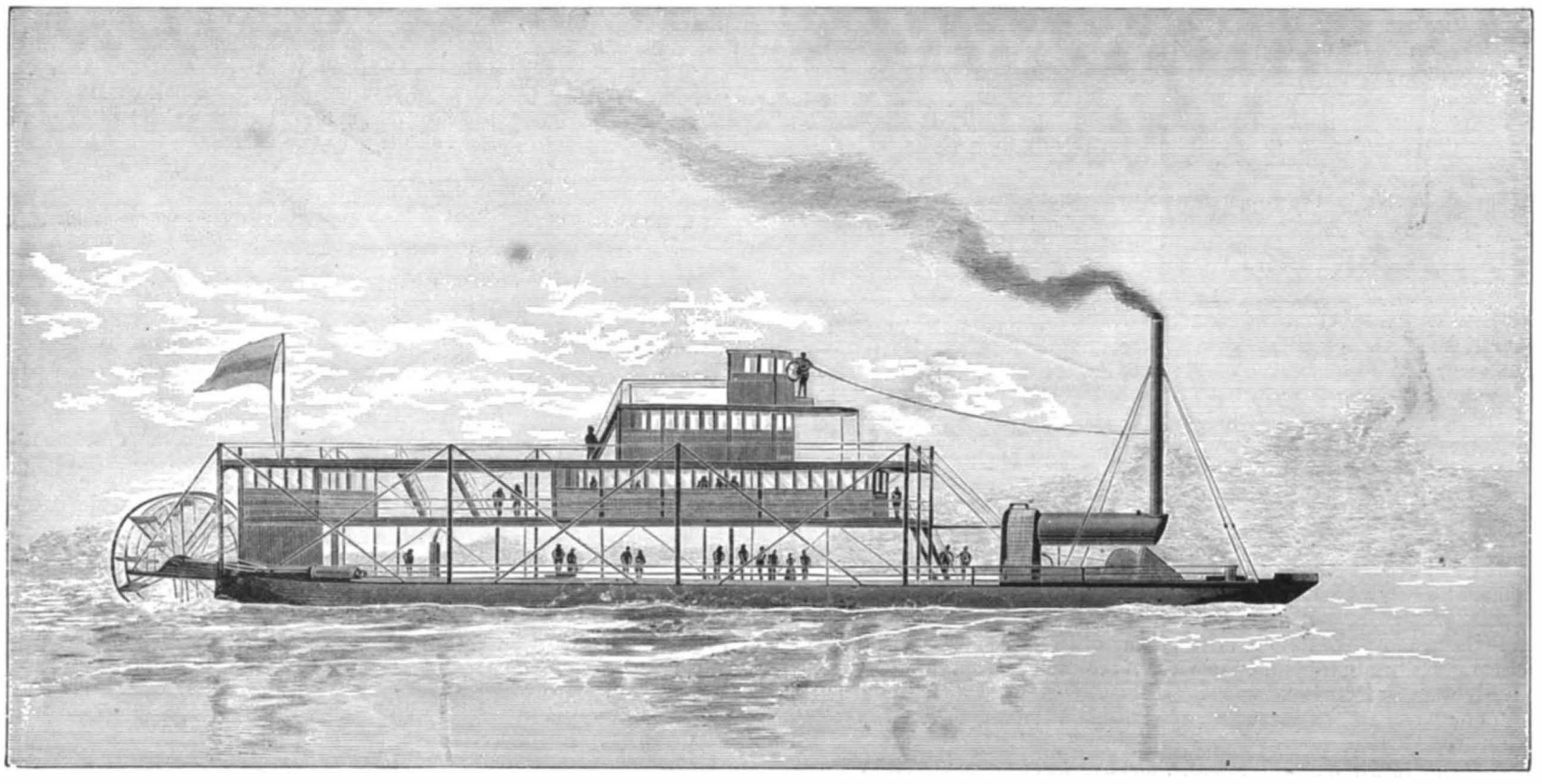
BOARDMAN'S TONGS.

are made angular and oblong in form, so that either of them may be used as a stove cover lifter.

This invention was recently patented by Mr. I. R. L. Boardman, of Snedekerville, Pa.

Prolongation of Life.

Some years ago the French Ministry addressed a circular to all the prefects, desiring them to institute inquiries as to the conditions which appeared peculiarly to favor longevity



STERN-WHEEL STEAMER OF STEEL FOR RIVER MAGDALENA SOUTH AMERICA.

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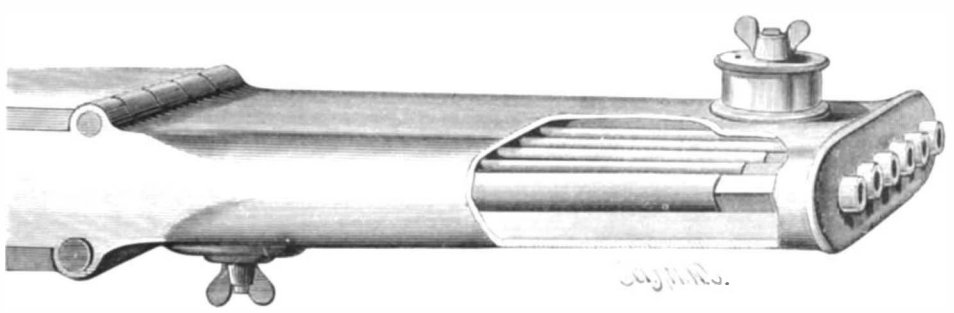
in their several districts, and the replies are said to have almost unanimously indicated as the leading elements or influences great sobriety, regular labor and usually in the open air, daily exercise short of fatigue, early hours, a comparatively well-to-do life, calmness of mind in meeting troubles, moderate intellectual powers. and a family life. The beneficial influence of marriage on the duration of life is universally admitted, and remarriage does not seem to be unfavorable. The prefects also indicate heredity as a frequent cause, and the influence of climate is likewise admitted; this latter, however, is separable with difficulty from other causes which may be operating simultaneously; but if all things were otherwise equal, it would seem that southern are less favorable to longevity than northern climates.

IMPROVEMENT IN MACHINE GUNS.

In machine guns the heating of the barrels has limited the number of charges that could be rapidly fired before they become too hot for use, so that after a period of rapid firing the gun would become dangerous if not allowed to cool. The engraving shows a device for keeping the barrels cool by surrounding them with water under atmospheric pressure, thus preventing the temperature from rising above the boiling point of water. A temperature not exceeding 212° Fah. does not impair the action of the gun.

The barrels are inclosed in a metallic water-tight casing having a vent for the escape of steam. The casing is filled from time to time during firing, as may be required. The mechanism for rapidly loading and firing is omitted in the engraving. This invention was recently patented by Mr. E. G. Parkhurst, of Hartford, Conn.



PARKHURST'S MACHINE GUN.

HOWE'S CAVE.

BY H. C. HOVEY.

The most massive and prominent rocks in Schoharie County, N. Y., are, first, the Water limestones, then the Pentamerus limestone, and above that the Delthyris shale. These all belong to the Helderberg division of the Silurian system. From the Water limestones immense quantities of cement are made. The rock lies in rather thin strata, and is easily acted on by the elements. The Pentamerus limestone is firm and compact, and abounds in fossils. The Delthyris shale is really granular gray or blue limestone, rich in coralline remains. These formations are so related to each other as to favor the excavation of deep valleys, flanked by cliffs and mural escarpments, the hills rising by successive terraces to mountainous proportions.

Several caves had already been found in this region, the largest of them being the one known as Ball's Cave, when in May, 1842, Mr. Lester Howe resolved to open what had previously been called the Otsgarage Cavern, but which now bears his own name. A stream of considerable size had long been observed flowing from it by several outlets. This subterranean river was the agent that had made the cavern; but it had afterward obstructed it by *débris*.

Mr. Howe hit on an ingenious plan for utilizing the water. He first loosened the clay, gravel, and broken rocks; then stopping other outlets he flooded the main channel, and thus forced the stream to sweep out its own deposits. This having been effectually done, he reopened the side passages, and made a dry path for 350 yards to Cataract Hall, where the waste water is now chiefly drained away through a transverse crevice. Another drain is at the Whirlpool, 100 yards beyond. These seem formidable terms to be applied to localities not in any way frightful to those visiting the cave in summer; but the guide assured me that during a rainy season the names were appropriate, and that there were times when the whole cavern would be filled, and, as he said, "pour forth a mighty flood."

The pathway beyond the drains crosses and recrosses the rapid, musical stream by stepping stones, until at a point about 1,350 paces from the entrance a double dam has been built, forming a pretty reservoir of extremely pure and limpid water. Iron pipes convey it out to supply numerous dwellings, a large mill, the hotel, and the tank at the railroad station. The supply has never been exhausted.

So much digging and blasting have been done between the entrance and the reservoir as to detract from the primitive wildness of the cave, and it too much resembles an unfinished railway tunnel. Gas, also, has been introduced, thus far with a pleasing effect ordinarily, though far less picturesque than torches and not free from danger. This appeared on the occasion of my first visit, which was in company with a party of 400 excursionists, many of whom caught hold of the pipes overhead to steady themselves along difficult paths. This procedure disturbed the flow of gas. A number of jets were extinguished; and although frequently relighted they could not be kept burning. The air grew heavy with escaping gas, which, being manufactured from gasoline, is very insidious, so that our first indication of peril was the fainting of several persons. I am satisfied that a fatal explosion was averted only by our resolutely shutting off the supply, thus leaving the party in darkness until torches arrived, by the light of which we withdrew to the purer and safer atmosphere above ground.

The next day we examined critically the whole system of lighting up the cave in company with Dr. Lewis, the chemist of the Boston Gas Works, our conclusion being that it is safe enough, if the pipes and jets are not tampered with nor allowed to be eaten through by rust. We would, however, recommend the substitution of electric lights.

It is due to Hon. J. H. Ramsey, the present owner of the cave, and Mr. J. M. Russell, the lessee of the premises, to say that every consideration is shown for the safety and comfort of guests, and that especial facilities were granted to us as explorers.

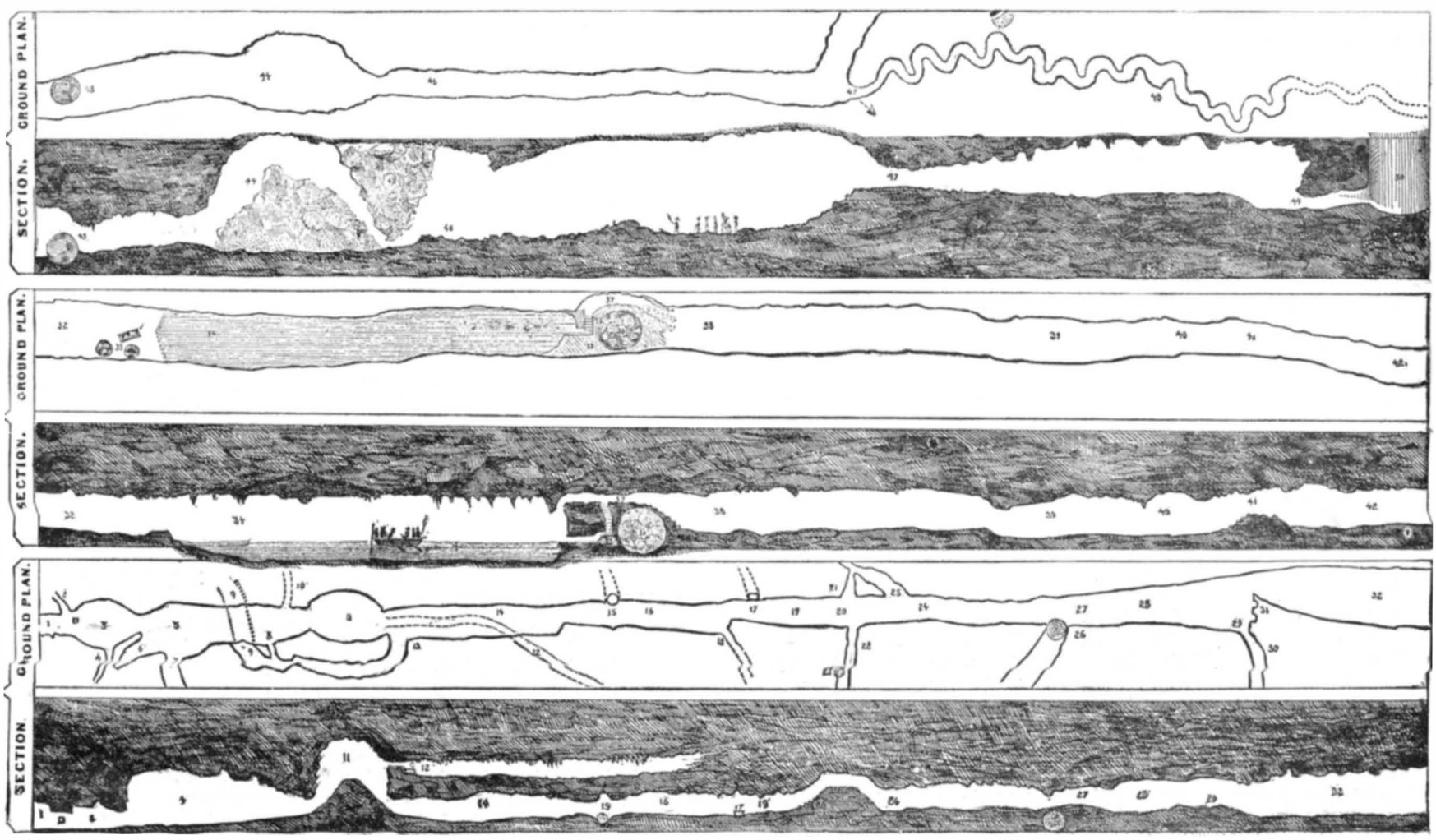
Our guide, Van Dyke, pointed out noteworthy objects, having an incident or legend to tell associated with each. Several romantic people have been married in a room 150 yards within the cave, called for that reason the "Bridal Chamber." It is reached by a long flight of steps, and ends in two or three interesting domes about 40 feet high. The temperature, which was 63° Fah. at the entrance, had here fallen to 50°, and that was found by repeated experiments to be the mean temperature of the cave. The mercury rose in certain places to 52°, and in others fell to 48°, the variation being probably attributable to atmospheric currents. The average is about 6° colder than the temperature of Mammoth Cave, nearly corresponding in each case with the mean temperature of the earth.

The currents of air vary considerably in intensity and direction, owing in a measure to the proximity of outlets and the windings of the cave stream. The air is chilly, and I missed the charming sense of exhilaration noted by every visitor to Mammoth and Wyandot caves, and rightly attributed to the natural oxygenation produced by chemical changes.

An incredible story is told of a young man from Georgia who was cured of pulmonary disease by dwelling three months in a dreary place called the Consumptive's Chamber. Beyond this is a large hall called the Giant's Chapel. Howe's Pillar is a mass of yellow alabaster, 12 feet high, reached by a side passage from Cataract Hall. From a point 1,000 paces within, a stalagmite was removed in 1874 and set up as an ornament in front of the hotel. This fact I have from the guide. Applying my pocket-rule to the new stalagmite that has grown up in its place within six years, it was found to measure 13 inches in thickness and 4½ inches in height. This is a remarkably rapid growth, compared with rates observed in other caverns, and will possibly constrain us to modify our estimates of their antiquity.

In the Haunted Room the imagination may decry spectral forms. But more interesting is the strong draught indicating the nearness of some large apartment, into which an entrance has not yet been effected. The echo in Music Hall prolongs aerial vibrations for only about five seconds. The resonance of the floor, as we tread upon it, again suggests a hollow place underneath. It is asserted in a pamphlet, published fifteen years ago, that there are fractures opening "into a giant cavern below." None were pointed out to us; and if such are known it would be well to explore them, for the present cave floor is far above the natural drainage level.

The reservoir, to which we have already referred, is called the Stygian Lake, and is navigable by a small boat. It is



MAP AND PROFILE OF HOWE'S CAVE, NEW YORK.

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about 16 feet deep when full, and is remarkably transparent. Among the numerous stalactites pendent from the roof, the guide singles out the Harp, which emits musical sounds on percussion. The lake is said to be a quarter of a mile long, though its width does not exceed 40 feet at any point. The sheet of water looks finely when illuminated with magnesium or by red fire.

Just beyond the landing place the passage is obstructed by a huge stalagmite reaching from floor to ceiling, and about 30 feet in diameter. Climbing around its upper portion by a narrow pass, we find ourselves on the edge of a pool that is apparently a continuation of the lake. It is surprisingly deep. We sounded to the depth of 35 feet without touching bottom, and took Van Dyke's word for its being 60 feet deep. As the surface of the water is only 45 feet above the level of the hotel, the bottom of this pool must be lower than the mouth of the cave; and the pit it fills may have been the former passageway of the stream to lower tiers of caverns underneath.

The cave now grows wider and with larger chambers as we follow the windings of the rivulet. Uncle Tom's Cabin stands 500 yards from the lake, and is a unique stalagmite of great dimensions, through whose base the flowing water has cut a tunnel by which one can gain the pathway beyond. Next is a hall about 200 feet long and 80 feet high, extending to a gigantic pile of rocky fragments, surmounted by several large stalagmites bearing fanciful names.

Descending from this eminence we find ourselves in a valley only about 10 feet wide, but of remarkable height. Masses of broken stalactites encumber the way, and 60 feet overhead is a projection, 25 feet square, called the Table Rock, accessible by hard climbing. The guide told us that this valley is 1,100 feet below the surface; a fact explained by saying that the cave pierced beneath a lofty hill, a spur of the mountains. We had no means at hand for either verifying or disputing this extraordinary statement; but we were led to doubt it because of the immense quantities of miry clay obstructing several branches that we attempted to explore.

The Winding Way trends to the right from the main cave line, and, together with what it leads to, is the most remarkable portion of the entire cavern. The ground plan of this underground cañon would resemble the peculiar articulation of the suture joining the bones of the skull. The Winding Way is from 2 to 4 feet in width, from 3 to 30 feet in height, and, as measured by us, about 550 feet in length. It is so crooked that it seems as if one changed his direction at every step. The walls are coated with translucent stalagmite equal in beauty to Mexican onyx, which it much resembles. I saw nothing finer in quality, even in Luray Cavern, where the display of Oriental alabaster is so exceedingly diversified and beautiful. The cañon is here and there curiously spanned by stalactitic arches. Having gone about two-thirds of the way through this bewildering passage, we come to a large cavity formed by the dislodgment of a triangular mass of rock which has wholly disappeared under the clay. The Winding Way ends in a circular aperture, through which one can barely crawl, by lying flat on the ground. This, of course, is called the Fat Man's Misery, a name without which the nomenclature of no cave would be complete.

Beyond this place of merry difficulties is the Rotunda, that ends the cave in this direction. There are many excavations in Mammoth Cave of the same nature as the Rotunda, the local name for them being "domes." Some of them are far larger, but none are more symmetrical. They are caused by the rotary action of whirling water freighted with sand and gravel, thus transformed into a powerful cutting engine. The diameter of the Rotunda is 25 feet, and its height was said by the guide to exceed 300 feet, in proof of which he alleged that rockets had been fired upward in it warranted not to explode until they had reached such an elevation. Moreover, it is said, and commonly believed, that no mortal ever saw the apex of the dome. It is a pity to break in upon such pleasant delusions, but regard for the truth compels me to say that by burning common red fire I saw the apex with distinctness; and comparing it with domes in Mammoth Cave, whose height is definitely known, I should say that the Rotunda does not greatly exceed 100 feet in height. But it is, without exaggeration, a very remarkable dome, and it pays the visitor for all the trouble taken in reaching it.

A degree of disappointment must be confessed as to the entire dimensions of Howe's Cave. Some enthusiastic letter writer once said that it was twelve miles long. The report on the geology of New York states that it has been "explored to a distance of seven miles, and seems to extend farther." A clerical friend assured me that it was at least six miles long. It is recorded that one avenue "has never been explored to its full extent, although a party once spent eighteen hours in it, traveling the whole time, and not reaching the end." Finding that the proprietors themselves discredited these statements, and had no objection to my measuring the cave, I accordingly undertook the task, assisted by my son, with this result: that the total combined length of all avenues open to the public is only *one mile and three-quarters*, and that there may be a mile or more additional of by-ways and tortuous crevices never shown to tourists; hence the owners are warranted in their honest advertisement that the entire length is about three miles.

The swiftness of the cave stream, and its liability to sudden overflow, must have prevented the aborigines from making this cavern a place either of residence or sepulture. It may be doubted, indeed, if they knew of its existence. Few animal remains have been found here. Large numbers of bats, however, hibernate in its chambers, clinging in clusters, like swarms of bees. No fish inhabit the lake or the stream, except such as have been put there by the hand of man, and even these forsake these subterranean waters when the spring freshets give them the opportunity to do so.

It should be said, in conclusion, that while Howe's Cave is far surpassed by several caverns in the subcarboniferous limestones of Virginia, Kentucky, and Indiana, it is the largest in this country that has been excavated from the rocks of the Silurian period. Its attractions are very considerable, and some of them are unique and highly remarkable. The cave is well worth visiting, especially as it is so easily reached from New York and the New England States. Its environs are picturesque, and from the piazza of the hotel a wide and beautiful view is commanded of the fertile valley of the Cobles-Kil, beyond which rises the wooded summit of a spur of the Catskills.

RECENT INVENTIONS.

An improvement in that class of ironing table that may be folded compactly together when not in use, so that it may be placed out of the way, has been patented by Mr. William G. Lindsay, of Winnebago, Wis. The invention consists in pivoting or hinging the ironing board to the ends of one of a double pair of hinged or pivoted cross legs, and securing to the under side of the board a ratchet-toothed spring bar, upon which the round of the other pair of cross legs may be placed at any required distance apart, by which means the height of the table may be adjusted.

An improved clasp for albums of all kinds, Bibles, and other books, so constructed that it may be easily closed even should the book be overfilled, has been patented by Mr. Carl Posen, of Offenbach-on-the-Main, Germany.

A water seal cup for waste pipes for refrigerators and for other purposes has been patented by Mr. Sylvester Gray, of Long Island City, N. Y. The invention consists in the combination of a bent wire with the water seal cup and the waste pipe, by which the cup is securely and detachably connected with the waste pipe.

An improved harness buckle has been patented by Mr. Robert D. Whittemore, of Chippewa Falls, Wis. The object of this invention is to provide a buckle which shall tighten with a side pressure upon the trace and hold the trace more securely as the strain upon it increases.

Mr. Samuel S. Gibble, of Mount Joy, Pa., has patented an improved insect trap. The object of this invention is to protect tobacco planters from the pest of the so-called "tobacco worms" (known as the larvæ of several species of *Lepidoptera* of the sphinx family), by capturing the parent moth prior to laying her eggs upon the plants, from which the worm is hatched. The invention consists in providing a wire trap with eyes or rigidly-attached loops to serve as a means for supporting it upon a staff or pole, and with a looped pendent wire for suspending the bait beneath the open bottom of the trap.

An improvement in the class of devices constituting an elastic or yielding support for thills or shafts of vehicles, whereby they are automatically raised and held elevated when the horse is detached, has been patented by Messrs. Allen C. Smith and Henry W. King, of Canaan, N. Y. In this position the thills are less liable to be broken or otherwise injured, besides occupying less of the available floor space in the carriage house, and likewise facilitating the reattachment of the horse.

An improved lock for holding reels to fishing rods, which is simple and effective, has been patented by Mr. Henry Prichard, of New York city. The invention consists of a sleeve surrounding the fishing rod, and provided with a notched internal shoulder at its upper edge, which engages with one of a series of studs on the metal casing of the rod. If the sleeve is passed down over the upper end of the plate or strip of metal to which the reel is attached, the lower end of which is passed into a suitable socket, the plate can be firmly locked in the desired position by turning the sleeve.

Mr. Henry O. Koschwitz, of Brooklyn, E. D., N. Y., has patented a method of making buttons and similar articles, consisting in turning the articles in a lathe first in one direction and then in a direction at right angles to the first, and then splitting or cutting the cylinder with rounded ends thus obtained longitudinally into several pieces, which are ground or planed and polished.

Mr. Henri B. Burin, of New York city, has patented an improved velocipede, which is so constructed that it may be used upon land and water with equal facility.

Mr. Thomas Leach, of Taun ton, Mass., has patented an improvement in baking dishes applicable to all kinds of analogous covered dishes, such as pickle casters, jewel cases, sugar or butter dishes, etc. The dish has novel means for maintaining the cover of the dish in suspended position above the receptacle.

An improved draught equalizer which is simple, strong, and endurable, and can be easily adjusted according to the strength of the animals and the resistance of the load, has been patented by Mr. Franklin H. Standefer, of Fort Payne, Ala. It consists in a doubletree provided with a vertical longitudinal slot, and made adjustable lengthwise on the doubletree bolt by means of a screw.

An improvement in gloves has been patented by Mr. Remus D. Burr, of Kingsborough, N. Y. The invention consists in extending the palm of a glove to form the little finger, thumb, and front and sides of middle finger, an obtuse angled cut being made from the base of the middle finger to the opening of the thumb.

Mr. Francis M. Cummings, of Porterville, N. Y., has patented an improved cheese curd sifter and picker, made so as to sift out the fine curd and pick the coarser or lumpy curd into pieces, reducing the curd to the desired fineness to receive the salt evenly with very little injury to the curd and loss of "white whey."

Mr. John Menahan, of New York city, has patented a pocketbook fastening, which is so constructed as to hold the pocketbook securely closed. It consists in a plate having one or more holes to receive the fastening pin and flanges upon its side edges to receive a sliding plate having one or more holes to receive the fastening pin, and slots between its holes to receive the neck of the fastening pin.

An improved hinge for folding bedsteads has been patented by Mr. Herman A. J. Rieckert, of New York city. This invention relates to hinges for folding bedsteads wherein the bed is fitted for being turned or closed into a stand or cabinet. The object is to furnish a hinge which will permit ready removal of the bed from the stand without the necessity of unscrewing the hinge; and this invention consists in a hinge having its leaves formed separate, one being made with the hinge pin as part of the leaf, and the other leaf made with a semicircular recess for the pin.

An adjuster for the slats of window and door blinds, so constructed that the slats can be adjusted into any desired position, and will be securely held in place, has been patented by Mr. John H. Monk, of Brooklyn, E. D., N. Y.

An improved apparatus or sweat house for curing and sweating tobacco to dark colors without developing any unpleasant or empyreumatic odors, which is unavoidable when the curing and sweating are done in the ordinary manner, has been patented by Mr. Charles S. Philips, of Brooklyn, N. Y.

Messrs. William W. Stratton and Adam Steuerwald, of Columbus, Ohio, have patented an improved cornice for curtains and lambrequins, which can be adjusted to suit any desired opening or space, such as a window, door, niche, and the like.

A labor-saving and effective process and apparatus for simultaneously softening and stretching hides and leather, has been patented by Mr. William Coupe, of South Attleborough, Mass. The invention consists in the application of revolving pin blocks to the surfaces of hides and leather in such a manner that the whole surface of the hide or leather is pressed or acted upon by the pins, and thereby stretched and softened.

An improved bag tie has been patented by Mr. Lewis A. Fish, of Faribault, Minn. The invention consists of a double-eyed double hook, whose hooked end is formed by bending the end up at right angles to the shank, then along the shank of the hook and parallel therewith, then upward again at right angles, and finally back on itself and parallel with the shank, and whose eyes are formed on the other end of the shank by loops extending laterally on either side.

Mr. George Oliver, of the City Road, County of Middlesex, England, has patented a novel apparatus for use in theatrical and other performances for suddenly raising a performer to a considerable height from the stage, the apparatus consisting, mainly, of an assemblage of vertical springs arranged overhead, the performer being connected thereto by a fine wire or rope. The object of this invention is to render the apparatus available for use in theaters or other buildings where there is not sufficient height to admit of the springs being placed in a vertical position.

A method of producing distinct and artistic patterns on pearl buttons has been patented by Mr. Charles L. Woodbridge, of Brooklyn, N. Y. The invention consists in first painting or sizing on the surface of the button, with some substance not soluble in a nitrate of silver solution, the pattern that is to be produced; then a solution of nitrate of silver is applied with a brush to the whole surface of the button, and the button then exposed to the light. The actinic effect of the light soon changes the color of the nitrate of silver either to a light brown or a darker color, according to the duration of the exposure and strength of the solution. Then the paint or size is washed off with spirits of turpentine or other resolvent, and the design is thus left clear and distinct in the natural color of the button on the face of the button, after which the design may be further wrought out by engraving and gilding.

Mr. Lucius S. Edleblute, of Cincinnati, O., has patented an improvement in the class of thill couplings or shackles in which the thill irons are adapted to be detached from the axle clips when raised to a vertical position.

How Church Tower Clocks are Wound.

The oldest tower clock in the city is in St. Paul's steeple. It was made in 1778 by John Thwait, of London. The clock in St. John's Church was put in the tower in 1812. The Trinity clock was placed in its lofty station, 200 feet from the pavement, in 1846, by James Rogers. In dry weather this clock runs well; but in damp, chilly weather it sometimes stops, owing to the precipitation of moisture on the wheels. Originally two men were required to wind it, each of the three 1,500 pound weights having to be lifted over 50 feet. Some time ago the winding gear was changed so that one man can now wind it.

Describing the operation of winding, the clock-keeper said, the other day: "The crank is about 20 inches long, and when I turn it around I make a sweep of 30 inches. It's a good deal harder than turning a grindstone, but the machine has a ratchet, so that I can stop and rest when I want to. The crank has to be turned 750 times to turn the barrel 21 times.

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Around the barrel is wound the wire rope that holds the 1,500 pound weight. The weight is simply a box with pieces of iron in it. That is very old-fashioned. Now we have iron weights so moulded that they can be added to or subtracted from, and the weight can be graded to a nicety. A new wire rope was put to the chimes weight the other day. The rope is what is called tiller rope, and is 280 feet long and three-quarters of an inch thick. It takes me an hour and a half to wind up the clock."

St. Paul's clock has a single back gear and two weights of 1,000 pounds each. It takes three-quarters of an hour to wind it. St. John's clock is wound in less than an hour; while the modern clock of St. George's, in charge of the same keeper, is wound in fifteen minutes.

THE FACE IN HEALTH AND DISEASE.

Among the earlier authors who were ignorant of many of the present methods of determining the condition, size, and position of the bodily organs (since the art of auscultation and percussion is a growth of later date), the study of the human countenance formed a very important part of the preparatory drill. The followers of Hippocrates and Galen were rendered perfect in their perceptive faculties. The former gave, in his masterly work, descriptions of disease which are still considered classic; while the latter, in his essays on the "Temperaments," is equally careful to note the most trivial alteration either of the face or of the posture. In modern times the diagnostic value of general physiognomy has been studied by De Salle, Jadelot, Siebert, Lavater, Laycock, Corfe, and others. Those who question the utility of this much neglected department of science would do well to read Darwin's great work on the expression of the emotions in animals, and the contributions of Connelly upon the typical shades of expression peculiar to the insane. With a view of systematizing and arranging the collected investigations of the above named authors, and bring within the compass of a single article such practical information as the anatomy of the face may afford the practitioner, Dr. Ambrose L. Ranney contributes an illustrated paper on the subject to the December number of the New York *Medical Journal*. The physiognomy of the sick presents innumerable shades of expression, and these may not only be the direct result of the influence of the ever-varying passions upon the muscles of the face, as is the case in health, but they may also be classed as morbid phenomena, each of which possesses some special significance. The diagnostic value of *facial lines and wrinkles* has had its share of support from many authors. These wrinkles may be classified in six groups:

(1) *The transverse rugæ*, situated on the forehead, and thought to be expressive of an extreme amount of pain arising from causes outside of the cavities of the body. (2) *The oculo-frontal rugæ*, extending vertically from the forehead to the root of the nose, and thought to express distress, anxiety, anguish, and excessive pain from some *internal cause*. It is said that when the first-named rugæ meet the latter abruptly during the course of an acute disease, some serious lesion of the brain, or its coverings, is developing. (3) *The linea oculo-zygomatica*, extending from the inner angle of the eye downward and outward, passing across the face below the malar bone. This, in children, is said to indicate a cerebral or nervous affection; and, in adults, some disorder of the genitalia. (4) The *linea nasalis*, extending in a curved line downward from the sides of the nose. This line is said to be strongly marked in phthisis and in atrophy. Its upper half is thought to be a reliable indication, if prominent, of intestinal disease; the lower half is supposed to indicate the existence of disease affecting the stomach. When it appears conjointly with the foregoing (No. 3), it is claimed that it may be regarded as a positive indication of worms in children, provided a peculiar fixed condition of the eye exists and a pallor of the face is present. (5) *The linea labialis*, extending downward from the angle of the mouth till it becomes lost in the lower part of the face. This is usually developed in connection with those diseases which render breathing laborious or painful, and is commoner in children than adults as a valuable diagnostic sign. (6) *The linea collateralis nasi*, extending from the nose downward to the chin in a semicircular direction. It is thought to be a reliable guide to diseases of the thoracic and abdominal viscera.

The nostrils are of practical interest from a medical standpoint. They dilate forcibly and rapidly in difficult respiration, when produced by disease; and itching of the nostril is regarded by many authors as a valuable diagnostic sign of intestinal worms. Marked elevation of the nostril is regarded by some authorities as an indicator of pain within the cavity of the thorax. The eye also affords many diagnostic signs. An irregularity of the pupils of the two eyes indicates, as a rule, pressure upon nerve centers or upon the optic nerve itself. In adynamic fevers the eyes are heavy and extremely sluggish, and are, as a rule, partially covered by the drooping eyelid; while in certain forms of mania they are seldom motionless. In "Bell's paralysis," due to failure of the facial nerve, the eyelids stand wide open and cannot be voluntarily closed, since the orbicularis palpebrarum muscle is paralyzed. In cardiac hypertrophy an unusual brilliancy of the eye is perceived. In scarlet fever a peculiar glistening stare exists, which is in marked contrast with the liquid, tender, and watery eye of measles. Many diseases of the eye itself tend to greatly alter the normal expression of the face, and prominent among these may be noted cataract, glaucoma, cancer, iritis, etc. Abnormalities of the pupils may afford the practitioner material aid in diagnosis. The pupils are found to be dilated during attacks of dyspnœa and after excessive muscular exercise, in the latter stages of anæsthesia, and in cases of poisoning from belladonna and other drugs of similar action.

A contracted state of the pupils exists during alcoholic excitement, in the early stages of anæsthesia from chloroform, and in poisoning by morphia and other preparations of opium, chloral, and some other drugs. Certain signs may also be had from the lips and mouth. In sickness, if the angle of the mouth be depressed, pain and languor may be read; and when the corrugator supercilii muscle cooperates with the depressor muscles of the mouth, acute suffering is proclaimed. Extreme pallor of the lips is seen in excessive hemorrhage, in purpura, in chlorosis, etc.; deep lividity denotes a defective oxygenation of the blood, and occurs in diseases of the lungs, heart, and larynx; while pale lividity occurs in cases where the circulation of the surface is languid or imperfect. In painful affections of the abdominal organs the upper lip is usually raised and stretched over the gums or teeth, so as to give a diagnostic expression to the countenance, which is considered by some as of great value. Many of the specific forms of disease have their own special physiognomy, which have a value to the diagnostician, but a further reference to which can scarcely be made in a short article like the present. It is to be hoped, however, that these facts from Dr. Ranney's paper, fragmentary as they necessarily are, may tend to awaken in the profession a renewed interest in a subject which is rapidly being lost sight of, and the value of which is often ignored. It is not to be expected that sight alone can guide the medical attendant to unerring diagnosis, but that it may prove of the greatest value as *an aid*, the facts adduced seem to render undisputed.

THE CHICAGO POLICE ALARM SYSTEM.

Mention has been made in this paper of the system of telegraphic alarms recently adopted in Chicago for police signaling. Sixty days' trial of the system in the 12th Street District has convinced the city authorities of the advantages of the system, and it is now proposed to extend it to the West Lake Street District, covering an area of over four square miles.

The public alarm-houses, as described by the city Chief of Police, are built of wood, and just large enough to admit a man. They are placed upon the sidewalk, as near to street corners as practicable, and securely fastened either to telegraph poles or corner stores. The keys to such houses are uniform; they are furnished to respectable citizens upon application at the station, and a record kept of the names of key holders. A mechanical alarm to register the location of the complaint is inclosed in a small box attached to the side of the house, which box also incloses a telephone for the use of the officer traveling that particular post, and which places the officer in direct communication with his commander at the station. The citizen who possesses a key can, by pulling down a lever which protrudes through a slit outside the box, procure the attendance of three policemen and a horse and wagon in from one to four minutes after entering the alarm-house. The wagon carries a stretcher, blankets, shackles, handcuffs, etc., and can be used either as an ambulance or conveyance for prisoners. The alarm-houses are furnished with patent locks, which, after opening, retain the key until an officer arrives with a master key, which he inserts in the reverse side of the lock and releases the original; this precaution is taken to prevent false alarms, and to keep the complainant at the alarm-house until the officers arrive to hear the complaint and apply the remedy. A large bell will be procured and erected upon each station, and at a given signal each officer in the district will be required to report immediately at the alarm-house upon his post, so that if any serious crime be committed in the district the officer in command at the station can summon each man on post duty, and telephone to his whole command at once, giving information to his men of the nature of the crime committed, and, if known, a description of the criminals, thus putting each patrolman on the alert to arrest the suspected parties.

In addition to these public alarm stations are private boxes combining police and fire alarm calls, which are to be placed in stores, offices, and dwellings at a cost of about $30 each. These boxes are so small that they can be set in a wall, behind a desk, or under a counter, and a noiseless alarm given, which will not disturb the thief or swindler until the officers arrive to make the arrest.

Fire-alarms can be given in the same manner, and registered at the headquarters of the Fire Department in one second after the alarm is turned in.

A Georgia Ice Factory.

A correspondent of the Hartford *Times* describes as follows the factory of the Georgia Ice Company at Atlanta:

On the ground floor is a boiler 50 feet long and 4½ feet in diameter, containing 150 feet of 3½ inch pipe. The boiler is kept filled with aqua ammonia, which is separated by the steam heat into ammonia gas and water. The gas, leaving the water in the boiler, forces its way through a 6 inch pipe outside the building to the roof, three stories up, where it passes into 15.000 feet of coiled pipes, in which it is converted into liquid by cold water thrown over it in fountain jets. This liquid passes into 15,000 feet of three-quarter inch pipe, arranged in vertical sections 30 feet high and 3 feet apart, and its sudden liberation into these pipes turns the liquid pure ammonia into vapor, and the sudden expansion makes the pipes intensely cold. Now, above these hundreds of vertical pipes are innumerable little fountain jets throwing spray all over the pipes, the spray freezing gradually, forming an immense icicle of pure ice around each pipe. The gas next goes into 15,000 feet of absorbing pipe, and, being cooled by water running on the pipes, it is met by water forced into the pipes, and thus converted back into aqua ammonia, which goes into the big boiler, and is not used over again. There is no waste, the same ammonia being used and reabsorbed any number of times. The water used for the spray is drawn from a well 75 feet deep, on the premises, and the large blocks of ice (which are loosened from the pipes by a little hot steam) come out pure and clear, and entirely free from any odor or objectionable taste.

After the pipes have been stripped, about five weeks are required for a new lot of the requisite thickness to form. But, of course, the pipes are never all stripped at the same time, the ice towers being in all stages of formation. The factory has a capacity of 35 tons per day, but 20 tons keep pace with the demand, and it isn't stored, but cut every day as it is delivered, and it sells at from $10 to $12 per ton.

ENGINEERING INVENTIONS.

Messrs. T. A. Trudelle and Eusebe Maheux, of Quebec, Canada, has patented an improved car coupling, which consists of a spring-actuated draw head and peculiarly adjusted levers operating a coupling pin, in combination with a spring-actuated draw bar, that serves to hold the coupling pin up when the cars are uncoupled.

Mr. Benjamin F. Walker, of Derrick City, Pa., has patented an improved clasp-packer for well-tubing joints to prevent the waste of oil when removing tubing from oil wells. The device is made in two semi-cylindical parts, hinged to each other at one side edge and fastened at the other side edges with a hook and pin, and provided with packing at its ends and side edges to adapt it to be clasped around the tubing at its joint, and having a side opening and hose to carry the oil to a receiver.

An improved engineer's level-rod has been patented by Mr. Michael L. Lynch, of Cameron, Texas. This invention relates to the class known as "self-reading level rods," and is distinguished from others by the peculiar manner of marking the scale upon the face of the rod, whereby the readings of fractions of a foot may be readily made without the use of a sliding target.

Improvements in steam generators, designed more particularly for generating steam for heating buildings, but applicable generally to the generation of steam for power purposes or other uses, has been patented by Mr. Nelson Coombs, of Titusville, Pa.

Mr. William J. French, of Carencro, La., has patented an improved device for securing nuts on railroad, bridge, and other bolts. The invention consists of a recessed segmental washer, in combination with a segmental forked or pronged clip locking in with said washer.

Barbed Wire Fence Patents.

In a recent issue the Chicago *Inter-Ocean* reports an important decision by Judges Drummond and Blodgett, of the United States Circuit Court for the Northern District of Illinois, with regard to the right to manufacture barbed fence wire. Fourteen suits were decided, all in favor of the complainants, the Washburn & Moen Manufacturing Company, of Worcester, Mass., and Isaac L. Elwood, of De Kalb, Ill., who are jointly interested in the patents involved, and are also largely engaged in the manufacture and sale of barbed fence wire. The decision is that all persons who have been manufacturing and selling the infringing barbed wire are liable for back damages. It is stated that Judge Lowell, of the United States Circuit Court of the Massachusetts District, had advised the complainants, who had several suits pending in his circuit, to await the decision of Judges Drummond and Blodgett. It is also reported that numerous suits pending in Iowa, Missouri, and other States have been suspended for the same reason, but will now be proceeded with. By this decision the complainants are shown to be the only parties who have the right to manufacture and sell barbed fence wire.

Uselessness of Chian Turpentine in Cancer.

Dr. Henry Morris, after giving Chian turpentine a pretty thorough trial in several cases of cancer, the details of which he gives in the *Lancet*, arrives at the conclusion that this recently vaunted remedy is utterly valueless in this dread disease. He says: "I am not able to report that there is a single symptom over which the drug seems to exercise even frequently, not to say constantly, an influence. It cannot be relied upon to assuage pain, to diminish or alter the character of the discharges, to check hemorrhage, or promote the destruction of the growth by ulceration or sloughing. In the few cases in which the patient at first thought she was benefited, the impression was due to that 'clutching at straws' tendency, that is so often observed in persons suffering from lingering and incurable disease, and to her being encouraged to think that she was taking a new and certain cure. Rest, regulation of diet, attention to the bowels, an anodyne at night, and the extra local cleanliness which follows from the use of injections and lotions, will of themselves, and without any internally administered drug, give temporary ease and improvement."

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A MYSTERIOUS EXPLOSION AND ITS CAUSES.

BY JOSHUA ROSE, M.E.

A singular explosion recently occurred at John Ellet's kindling-wood manufactory, at 529 West 55th street, in this city. The bare facts are as follows: The boiler was licensed to carry 100 lb. of steam, but was usually worked at from 35 to 50; at the time of the explosion there was a pressure of 50 lb. A circular-saw bench stands about 16 feet from the boiler; the saw overhung the bench at one end of the spindle, while a fly wheel overhung it at the other end—the plane of rotation of this wheel being about in a line with the center of the vertical boiler. There was a pile of wood inside the saw bench, which was about 18 feet distant from the boiler, and the operator was standing at this pile of wood and between the saw and the fly wheel, facing the boiler, when a sudden explosion occurred, and a heavy volume of steam shot in a straight line upon the operator, very severely scalding him. He fell behind the pile of wood, whose partial protection probably saved his life, though at the time of this writing he lies in a very precarious condition. The boiler belched forth its steam in a solid column until emptied, and it was then found that the circular saw, with its spindle and the fly wheel, had disappeared, while there was a hole in the boiler measuring about 3 inches by 6 or 7. A short piece of the saw spindle was found, and on it the part of the saw shown in our engravings at Fig. 2. Other pieces were found embedded in the timbers of the building, where a piece still lies entirely out of sight. A piece of the rim of the fly wheel was found beside the hole in the boiler, which is shown in Fig. 1. Another piece was found about 500 feet distant, in Tenth avenue. But not more than one quarter of the wheel has been found at all, the remainder having totally disappeared. One piece in its flight tore a groove about 2½ inches wide in a beam and passed through the roof. Of the circular saw about three quarters have been found, the remainder being missing. The spindle tore itself out of the bearing caps and was found in the yard minus all the fly wheel except the hub, and minus the circular saw and the overhanging piece of shaft.

The spindle was 2¼ inches diameter, of wrought iron, and about 4 feet long. The saw was about 26 inches in diameter, and, contrary to the usual practice, was slightly thicker (say, one thirty-second of an inch) at the eye than at the rim. The fly wheel was about 30 inches in diameter, being a plate wheel with a web three-eighths inch thick.

A great many mechanics, as well as some of the authorities, have been investigating the matter to discover the cause of the explosion, and some of the latter are still investigating it for their private information. The general opinion prevails that all the materials were of good quality and sound, and that the saw flew first, and the spindle and fly wheel simultaneously, though at first it was supposed that the boiler was the first thing to give way. But there is an atmosphere of mystery surrounding the affair, and nobody seems to have any distinct theory of the order in which the casualties occurred, and no theory whatever as to the causes leading to them. Pieces of the fragments have been preserved as curiosities, and this possibly accounts for some of the missing parts.

The man in charge afforded me every facility to investigate in my own way, stating that the proprietor, Mr. Ellet, was one who spared no expense to have his machinery kept in the best order; that the establishment was nearly a new one, having run about three months, and that he, as much as anybody, was anxious for a solution of the mystery. The saw itself had been running about two months, but the spindle and fly wheel, or, more correctly, balance wheel, was old, having been running nobody knew how long in a circular saw mill in another establishment.

The fragments of the saw were first examined. The metal appeared close grained and tough, with no signs of any thing but new clean fractures. Various pieces were tested by being bent back and forth with a hammer. It appeared sound and tough; indeed, of excellent quality, each piece tested having a clear ring. A file test showed it of even temper, and if anything, rather soft than otherwise, which added to its strength. Those who examined it state that it was quite cool when picked up after the accident, and that there were no signs of heating either in it or the spindle. The fractured piece of boiler had been preserved as a curiosity by one of the workmen, but it was submitted for inspection, and is shown in Fig. 1. It was five-sixteenths of an inch thick, of good sound fibrous iron, very free from scale, even the line made by the calking tool being clean and clear. The rivet holes were clear and as round as could be expected. It had clearly been fairly burst open by a flying fragment, there being on opposite sides of the rent two bright places as clearly cut as though cut by a milling tool: it was bulged out, or rather inward, an inch or two from the force of the blow. Failing to find any cause for the accident in either the boiler or the saw, the saw spindle was next examined at the blacksmith and machine shop of Messrs. Potter & Macdougall, who were making a new spindle of steel. The piece that flew off with the saw showed a clean, short fracture, with a fine dark line running across it, ending in a small flaw. The shortness of the fracture and absence of any signs of fiber in the iron led to a suspicion that the iron was crystallized, an opinion with which Mr. Potter concurred; but the other side of the fracture (on the main body of the spindle) showed the fine dark line a part of the way only, and no signs of any flaw, while the circumferential surfaces of both pieces appeared quite sound. With a view to test the soundness of the spindle, I had the spindle made red hot and cold water poured upon its end, and as a result there appeared a crack whose outlines became apparent in a black line, caused by the rapid cooling of the crack edges on one side; this darkness developed a complete cavity about half an inch deep, this cavity corresponding in location to the flaw at the end of the black line in the other half of the fracture shown in Fig. 3. To test if this crack ran along the shaft, and to see the difference in the grain of the iron, a piece was broken off the spindle end, the fracture being shown in Fig. 4, the crack having disappeared. The remaining end of the shaft was then annealed to see how far such annealing would remove the granulation and restore the fibrous structure of the iron, and the fracture of a piece broken off after the annealing is shown in Fig. 5. The remaining end of the shaft was then forged down square, the fracture being shown in Fig. 6. Here the grain shows a close, clean, dull-gray fiber, and an entire absence of the granular crystals. It will be noted that the original fracture is the shortest and the most granular, and that the iron became more fibrous after the annealing and after the forging, the latter having totally altered the structure. Referring to the piece broken off before the annealing, its fracture shows a far superior one to that occurring with the explosion, but more granulation than the annealed piece, and in this connection it may be stated that Mr. Potter, of the firm named, informed me that to remove the crystallization Messrs. Caird & Co., the eminent engineers of Greenock, Scotland, made it an annual practice to take down, during the Christmas holidays, the chains from all their heavy lifting cranes for the purpose of annealing them—a practice, indeed, that is followed in many of the large engineering establishments in England.

The method of effecting the fractures was as follows: Each piece was nicked around with a cold chisel; the piece was then put under the same steam hammer, the weight of the hammer holding the piece, and the side face of the hammer being even with the nick, the protruding end being broken off by sledge hammer blows. The chisel nicks are of equal depths, measuring 1⅝ inch at the bottom of the nick for the two pieces, Figs. 4 and 5. But it was found that the annealed piece took more blows and more forcible ones to break it, as is shown by the hammer marks in Figs. 7 and 8. The flattened places are those made by the sledge hammer to produce the fractures, those in Fig. 7 evidencing how much stronger the annealed was than the unannealed piece.

The heights of the various fractures are shown as evidencing that in proportion as the location of the fracture was receded from, and as the metal was worked (either by annealing or forging), the metal improved. It is probable that the crystallization of the metal proceeded more rapidly at the line of original fracture because of the presence of the flaws, which would induce increased vibration at that cross section when in rapid motion.

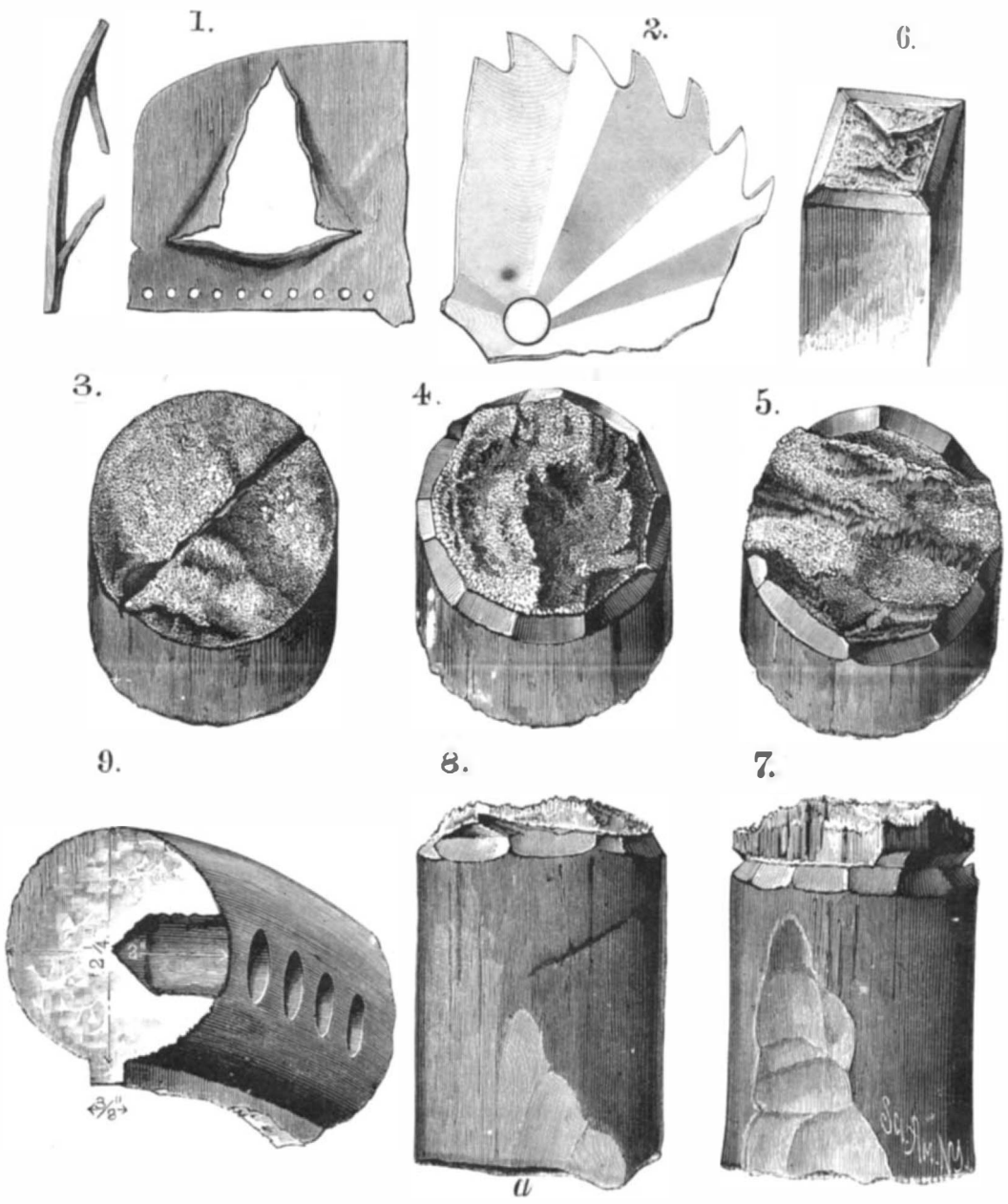
a, in Fig. 8, is a side view of the original fracture to show its shortness.

It is suggested that some of our technical mechanical schools test these pieces of spindle for torsional strength, to see if the order of strength agrees with the apparent order of crystallization and the effect of the reforging. The conclusion appears unquestionable that the shaft broke first, for the following reasons: Had the saw broke it would have simply left the spindle in its bearings with the fly wheel in place. If the fly wheel broke first, it should have left the spindle all right running in its bearings. But as soon as the spindle broke the saw would revolve eccentrically, generating a force sufficient (at the great speed) to cause the breaking of both the fly wheel and the saw, and account for the spindle tearing from the bearings.

The bursting of the fly wheel is plainly due to the holes drilled in it, and it is unaccountable how any mechanic could commit such a blunder as to drill such holes in such a location; their number, and size (as shown in Fig. 10), preclude the idea that they could have been made to balance the wheel, especially as it appears a well-shaped casting, and was a web or plate wheel. In the only other piece of the wheel rim found there are none of these holes, and the fracture occurs in the center of a hole, all pointing to the same conclusion, namely, an unbalanced wheel whose explosion caused all the damage.

It is only proper here to express thanks to Messrs. Potter & Macdougall for their kindness in placing a blacksmith at my disposal, laying other work aside to test the pieces as described in the interest of science, and refusing compensation for the same.

The diameter of the fly wheel being thirty inches, and its revolutions being 2,000 per minute, its velocity was over 500 miles an hour; but in this connection it may be stated that the diameter was estimated by the attendants, who did not know as to its correctness, there being not enough of the wheel left to ascertain its exact diameter, the piece shown in Fig. 10 being the largest remaining. The iron of the wheel looks close-grained and of good texture, the break being around the web close to the rim and across the rim. That at the center of one of these holes is undoubtedly the original fracture, the other fractures occurring subsequently.



FRACTURES CAUSED BY A MYSTERIOUS EXPLOSION.

OWING to the severe competition of Swiss and German factories the manufacturers of St. Etienne, France, are arranging to substitute gas for coal as a source of power for looms and the like. As there are coal mines in the neighborhood of St. Etienne, it is expected that the gas will be cheap, and that by its use the productive power of the machinery will be increased at least fifty per cent.

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CURIOUS TIME MEASURERS.

When clocks passed out of the hands of blacksmiths the inventive faculty was quickly at work among the new school of clockmakers to make portable timekeepers. The idea must have been carried out practically late in the fifteenth century. In a tract printed at Antwerp in 1530, Gemma Frisius writes of small clocks, or watches, as "lately invented." The earliest maker with whose name we are acquainted is Peter Hele, who, about the year 1490, made watches which (being oval, and also in honor of Hele's native city) were called Nuremberg eggs. These were principally made of steel; they moved without weights, pointed to and struck the hour, and could be carried on the person. Catgut was used in the earlier watches in place of chains; the latter, it would seem, being first attached to such mechanisms in the golden egg or acorn-shaped watches of Hans Johns, of Königsberg. Some of this maker's timekeepers had small wheel-lock pistols to serve as an alarum, an addition that would go far to upset the equable temperament and delicate susceptibilities of a modern chronometer.

Gaspar Visconti, a Milanese poet, alludes to watches in a sonnet written in 1494, so these time measurers must have come into sudden notoriety. The early watches were mostly large and richly chased. There was one such in Sir Ashton Lever's collection, with the date 1541, but by the next year we find a striking watch mounted in a ring, so the makers must quickly have modified the size of the works. Watches in these times were greatly prized, and but rarely found in the possession of any but of royal or noble persons. The makers were busy, however, if not intent upon turning out many, at least in improving the quality of those finished. Dr. Derham describes a watch said to have belonged to King Henry VIII., which only required winding once every seven days, and Anne Boleyn had a similar one. The Emperor Charles V. had a remarkable taste for delicate mechanisms, and his passion for watchmaking was adduced in proof of his insanity by Voltaire.

There is a watch of about this period in the Loan Collection at South Kensington, which is believed to have been worn by Lord Hussey, who was beheaded in 1536. It is in a silver case, with key attached, and is very diminutive. The name of the maker, R. Crayce, is engraved inside. This is the property of Lord Audley. There is another early watch of silver-gilt, and English make, dated 1539, lent to the Museum by Count Edward Stuart d'Albaine.

In Elizabeth's time watches had come into more general use, though it does not seem to have been an uncommon thing to borrow a timekeeper. The Earl of Leicester, Elizabeth's master of the horse, presented the Queen with "a rounde clocke [*i. e.*, watch] fullie garnished with diamondes," which was suspended to an armlet. The Virgin Queen seems to have been in luck's way, for, in 1574, Margaret, Countess of Derby, gave her "a white beare of gold and another of pearle, holding a ragged staffe, standing upon a tonne of gold, whearin is a clocke." The "clocke and all" weighed three ounces.

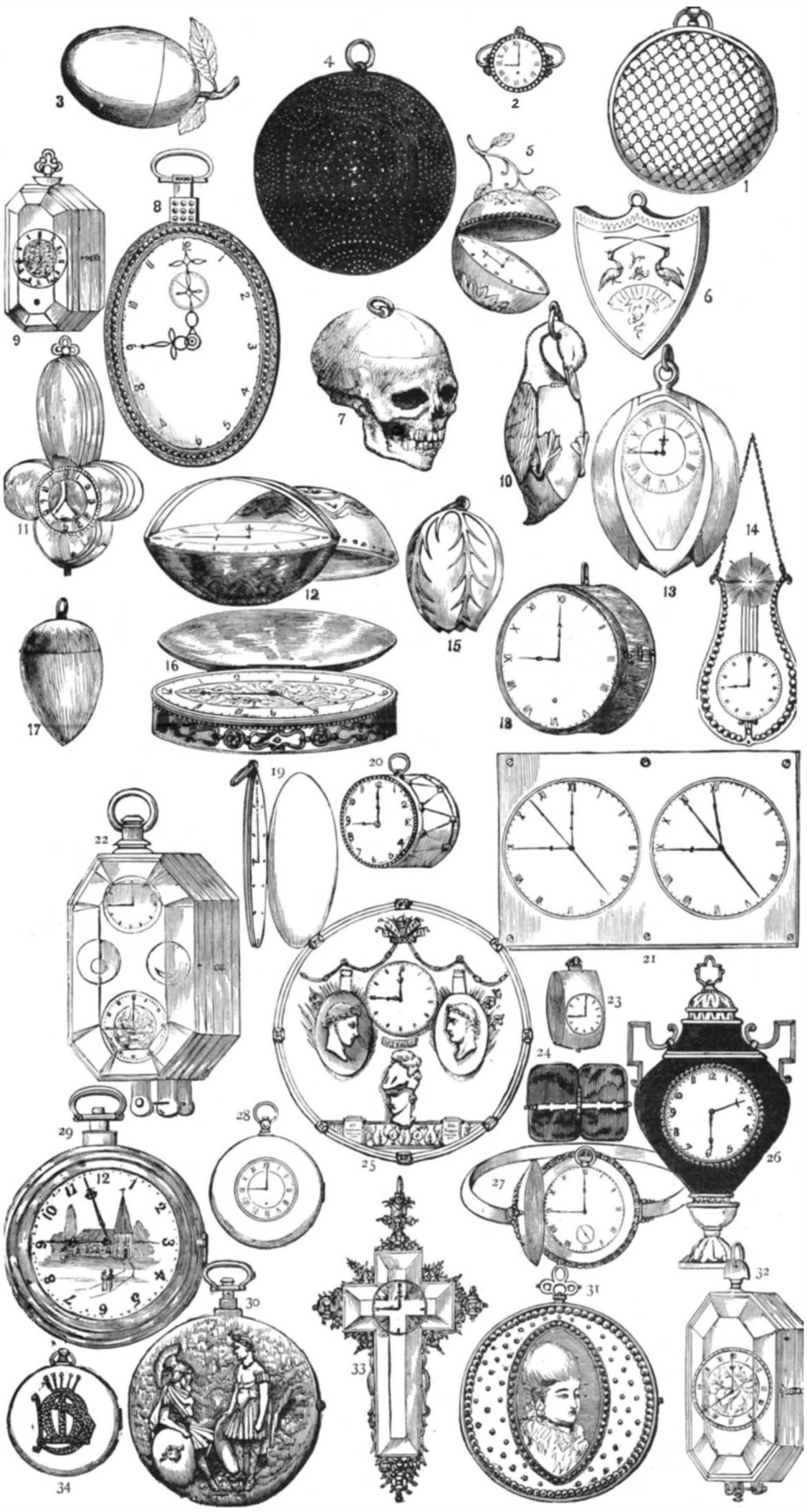
Mary Queen of Scots had several watches of a gruesome and lugubrious character. One was in a crystal case, coffin-shaped; another, which she bequeathed to her maid of honor, Mary Setoun, was in silver-gilt, in shape of a human skull. Upon the forehead was engraven a scythe and hour glass placed between a palace and a cottage, to show the impartiality of death. At the back of the skull was Time destroying all things, and on the top scenes of the Garden of Eden and the Crucifixion. The watch was opened by reversing the skull, placing the upper part in the hollow of the hand, and lifting the hinged jaws. These "memento mori" watches were most likely intended for a "Prie-dieu," or small altar, in a private oratory. At South Kensington is a small silver watch of English make in the form of a skull. Inside is inscribed the maker's name, "Isaac Lenard"—Penard (?)—and in the Fellowes Collection at the British Museum is a similar watch of Swiss manufacture, by J. C. Voulf, about the year 1600. There are other peculiarly-shaped watches of the same period extant. At South Kensington is a silver watch formed like a duck hanging by the neck. It is two and seven-eighths inches in length, and by a German named Henry Ester. One of this maker's watches in the British Museum is tulip shaped, and dated 1600. Another small tulip timekeeper is at South Kensington, with the name, "Henry Grerdon, at ye Exchange, fecit," within. The same collection contains a watch in the form of a cross, with gilt-metal frame, and pieces of crystal in front, back, and sides; and one with a group on the top—a Venus and Cupid, with dog—the watch bearing the maker's initials, "N. K." At the British Museum is a German cruciform dial, presented by A. W. Franks, Esq., made by Melchior Reichol in 1569; also an English watch in the shape of a fritillary flower, by Edward Brysse, date 1580; and a German octagonal watch with date 1550 (*temp.* Edward VI.). The Scottish Society of Antiquaries have a watch of Sir Walter Raleigh's, which belongs to a subsequent period. Watches were no doubt greatly prized, and we hear of one of the useful articles being presented by a Polish nobleman to Erasmus; and in the will of Archbishop Parker, dated 1575, his "staff of Indian cane, with a watch on the top," is bequeathed to the Bishop of Ely.

James wore a finger ring with a watch set in the jewel. One of his timekeepers (extant) is oval, and nearly all brass. The dial is a silver ring one-eighth of an inch wide. The hours are engraved in Roman numerals, and there is a small stud at the base of each, so that the hour could be ascertained by the touch in the dark. Above the dial are figures of Leda and the Swan, and below a cherub's head between two foxes. In this watch catgut is used instead of a chain. The king, writing from Windsor, April 18, 1623, to his "sweete boyes," who were in Spain, sends jewels for the Duke of Buckingham, the prince's companion, to give away; one is "a clocke of goulde, garnisht on the one side with letters of dyamondes, *Dieu et mon droyte;* and on the other side a cross of dyamondes fullie garnisht, with a pendante of dyamondes."

Charles I. had two watches, one of gold and one of silver, placed near a lamp upon a stool at his bedside. On the morning of the unhappy king's execution, while on the way to Whitehall, he gave the silver watch to Sir Thomas Herbert. This is still preserved. It is richly chased, three inches in diameter, and one and a quarter thick.

In the Fellowes Collection at the British Museum is a watch formerly worn by Milton. It is of silver-gilt, and steel faced, the dial covered by a glass. Upon the face is inscribed "Ioanni Miltoni, 1631." It was made by "William Bunting, in Pope's Head Alley."

In the same rich collection are two oval silver watches



CURIOUS TIME MEASURERS.

1. Back of Watch, chased case.—2. Watch in finger ring.—3. Acorn-shaped watch.—4. Shagreen case, ornamented with pique; English, 18th century.—5. Gold, apple-shaped watch; case enriched with seed pearls; date 1760.—6. Gold shield-shaped watch; arabesques in transparent enamel; Swiss, 18th century.—7. Memento mori watch, by Isaac Penard.—8. Oval watch, by Anthony; hands contract and elongate.—9. Crystal case watch, by Henry Grerdon.—10. Henry Ester's duck-shaped watch.—11. Crystal-case watch, form of fleur-de-lis.—12. Watch with spherical gilt case minutely chased; works swing so as to balance in all positions.—13. Crystal case mounted in bronze gilt; tulip shaped, French, 1700.—14. French lyre-shaped watch.—15. Small tulip-shaped watch, by Henry Grerdon.—16. Watch with metal case.—17. Acorn-shaped watch.—18. Drum-shaped watch.—19. Thin modern watch.—20. Watch charm, shape of drum.—21. Double chronograph, to fix on field glass.—22. Watch with seconds hand; crystal case.—23. Lord Hu sey's watch.—24. Case for ditto.—25. Watch medallion.—26. Vase watch, 18th century.—27. Bracelet, with watch, to unfix.—28. Modern "half hunter."—29. Old-fashioned watch face.—30. Back of modern watch, enameled.—31. Back of modern watch, enameled and set with pearls.—32. Crystal-case watch.—33. Silver-gilt watch in form of edged cross, decorated with garnets and crystals; German; 17th century,—34. Lady's gold watch, real size, initials and coronet in diamonds.

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made in 1650, and said to have been the property of Oliver Cromwell. One bears the Cromwell family crest, and the inscription, "John Midnall, Fleet street." There is also another watch in the Ashmolean Museum, which without doubt was the great Protector's.

South Kensington has several watches of seventeenth century make. One is of silver, fluted, and shaped like a pecten shell. It has a chased and engraved dial, and bears the name of the maker, "Pierre Combrel à Lyon." Its size is two and a half by one and three-quarters inches. Another watch is in the form of a fleur-de-lis, with gilt dial plate and outer case of plain silver. It dates about 1650, and its maker's name is "G. Senez, Orologier du Roy à Rouen."

The greatest improvements in the art of watchmaking are due to the seventeenth century, when the studious minds of Huygens and Dr. Hooke were directed into this channel. Dr. Hooke, an irrepressible and cosmopolitan "scientist," originated the spiral or pendulum spring, and this was improved upon by Thomas Tompion, who had been a farrier, and tried his prentice hand at watch-work by regulating the wheels of meat-jacks. Tompion was a famous watchmaker of the day, and Dr. Hooke induced him to construct a watch upon the new principle for Charles II. From this period watches became real timekeepers, and the improvements introduced since have been mainly to counteract the varying effects of cold and heat upon the metal of which the works are constructed, and in rendering the working parts less liable to friction, until the precision and mathematical accuracy of these machines justly entitled them to the eulogy of Paley, who selected watches as exhibiting the highest specimens of human ingenuity.

At one time it was fashionable to wear two watches, to compare the one with the other. In the "Universal Magazine" for 1777, we find a "Receipt to make a Modern Fop," which includes, among other ingredients,

> "A lofty cane, a sword with silver hilt,
> A ring, two watches, and a snuffbox gilt."

Some, too poor or too niggardly to sport the usual couple of watches, wore a *fausse montre*, or dummy watch, in one pocket, and the real watch in the other. This carrying of two watches at one time was as nothing compared to the whimsicality of a Saxon Minister, Count Bruhl, in whose wardrobe, when the Prussians took Dresden in 1757, were discovered suits of clothes for each day of the year, and 365 watches, sticks, and snuffboxes, respectively.

We have seen that striking watches were of an early date, and stories are told of the detection of thieves in a crowd by the watches they had abstracted striking the hour at a *malapropos* moment. Charles XI. of France discovered a *chevalier d'industrie*, who had eased him of his watch in this manner. When "repeaters"—which strike the hour at any time by pressure upon a certain part of the watch—came in, seems to be unknown. They are mentioned in Bolingbroke's "Letters on the Study of History" (written about 1711, thus: "When you press a watch, or pull a clock, they answer your question with precision, for they repeat exactly the hour of the day, and tell you neither more nor less than you desire to know."

At South Kensington there are some beautiful specimens of seventeenth and eighteenth century repeaters. One is of metal gilt, in size 5⅛ by 4⅛ inches. Upon the dial plate is engraved the entombment, after Lucas Van Leyden. This watch is dated 1630, and the name of the maker, "Nicholas Lemandre à Blois," is added. Here is also a gold repeater in a shagreen case, by "J. Trubsham, London," the property of Miss Gerard, and said to have been formerly in the possession of Bishop Berkeley. Another in the same collection is believed to have been worn by George I. It is a repeating watch in a double case, the inner one being pierced and engraved, and on the back are the royal arms, surmounted by a crown. The outer case is *repoussé* and chased, with a horseman hunting a boar. It is 2¾ by 1⅛ inches in size, of German manufacture, the maker's name being "George Albrecht." A contrivance called a "pulse piece," and by the French a "deaf piece" (*sourdine*), was subsequently added to repeaters. In these watches a small button projected from the rim, nearly opposite the pendant, and when the watch was made to repeat the time, and the finger was pressed upon the button, the number of strokes upon the bell could be distinctly felt. The touch watch (*une montre de touche*) was a later invention by Brequet, a famous French maker. Here the hours were indicated by eleven buttons, or studs, projecting from the rim of the case, and the pendant marked twelve o'clock. There was an index hand at the back which, moved forward, stopped at the time shown upon the dial; this, combined with the studs, enabled one to feel the time.

Some of the last century watches are highly ornamented, and other specimens display great ingenuity. South Kensington has a French lyre-shaped watch, set with pearls and enameled, and surmounted by an image of the sun. Another, in the form of a very small apple, has a gold enameled case, and is surrounded by a belt of seed pearls. This was made at Geneva about 1760. In the Gardner collection at the same museum is a watch in an oval gold case, highly decorated with pearls and diamonds, set in enamel, the hands of which contract and elongate to suit the form of dial. This is by "W. Anthony, London." The clock of the cathedral of Lyon, made by Lippius de Basle, had a similar dial, and the single index became longer or shorter to suit its form. To return to the collection at South Kensington, there is a watch, the property of T. Dyer Edwards, Esq., originally belonging to the Duke of Marlborough, by whom it was given to Sir Isaac Newton in 1714. It is of silver, with *repoussé* and open work cover, and is of German make. Another watch presented to the great astronomer is in the possession of the Royal Society.

Miniature watches are little thought of now; precision is everything, as it should be; and this has culminated in the chronograph, a wonderful invention of our own day, by which the great horse races are usually timed. The precise moment the starter's flag is lowered is indicated upon the dial by a spot of ink, and another dot shows with equal exactitude the time at which the first horse passes the judge's chair.—Reprint from *Leisure Hour* in *Illustrated Christian Weekly*.

The Care of Steam Boilers.

INSTRUCTIONS TO BOILER ATTENDANTS.*

Getting Up Steam.—Warm the boiler gradually. Do not get up steam from cold water in less than six hours. If possible, light the fires over night. Nothing turns a new boiler into an old one sooner than getting up steam too quickly. It hogs the furnace tubes, leads to grooving, strains the end plates, and sometimes rips the ring seams of rivets at the bottom of the shell.

Firing.—Fire regularly.—After firing open the ventilating grid in the door for a minute or so. Keep the bars covered right up to the bridge. Keep as thick a fire as the quality of the coal will allow. Do not rouse the fires with a rake. Should the coal cake together, run a slicer in on the top of the bars and gently break up the burning mass. It has been found by repeated trials that under ordinarily fair conditions no smoke need be made with careful hand firing.

Cleaning Fires and Slacking Ashes.—Clean the fires as often as the clinker renders it necessary. Do not slack the clinkers and ashes on the flooring plates in front of the boiler, but draw them directly into an iron barrow and wheel them away.

Feed Water Supply.—Set the feed valve so as to give a constant supply, and keep the water up to the height indicated by the water level pointer. There is no economy in keeping a great depth of water over the furnace crowns, while the steam space is reduced thereby, and thus the boiler rendered more liable to prime. Nor is there any economy in keeping a very little water over the furnace crowns, while the furnaces are thereby rendered more liable to be laid bare.

Glass Water Gauges and Floats.—Blow through the test tap at the bottom of the gauge hourly, as well as through the tap in the bottom neck, and the tap in the top neck twice daily. These taps should be blown through more frequently when the water is sedimentary, and whenever the movement of the water in the glass is at all sluggish. Should either of the thoroughfares become choked, clean them out with a wire. Work the floats up and down by hand three or four times a day to see that they are quite free. Always test the glass water gauges and the floats thoroughly the first thing in the morning before firing up.

Blow-Out Taps and Scum Taps.—Open the blow-out tap in the morning before the engine is started, and at dinner time when the engine is at rest. Open the scum tap when the engine is running, before breakfast, before dinner, and after dinner. If the water be sedimentary, run down half an inch of water at each blowing. If not sedimentary, merely turn the taps round. See that the water is at the height indicated by the water level pointer at the time of opening the scum tap. Do not neglect blowing out for a single day, even though anti-incrustation compositions are put into the boiler.

Safety Valves.—Lift each safety valve by hand in the morning before setting to work to see that it is free. If there is a low water safety valve, test it occasionally by lowering the water level to see that the valve begins to blow at the right point. When the boiler is laid off, examine the float and lever and see that they are free, and that they give the valve the full rise. If safety valves are allowed to go to sleep, they may get set fast.

Shortness of Water.—In case the boiler should be found to be short of water, draw the fires if practicable, and draw them quickly, beginning at the front. In some cases it may be more convenient to smother the fires with ashes or with anything else ready to hand. If the fires are not drawn leave the furnace doors open, turn on the feed, lower the dampers, shut down the stop valve if the boiler be one of a series, and relieve the weight on the safety valves so as to blow off the steam. Warn passers-by from the front of the boiler.

Use of Anti-incrustation Compositions.—Do not use any of these without a thorough knowledge of their effects. If used, never introduce them in heavy charges at the man hole or safety valve, but in small daily quantities along with the feed water.

Emptying the Boiler.—Do not empty the boiler under steam pressure, but cool it down with the water in; then open the blow-out tap and let the water pour out. To quicken the cooling the damper may be left open, and the steam blown off through the safety valves. Do not on any account dash cold water on to the hot plates. But in cases of emergency, pour cold water in before the hot water is let out, and mix the two together so as to cool the boiler down gradually and generally, and not suddenly and locally.

Cleaning Out the Boiler.—Clean out the boiler at least every two months, and oftener if the water be sedimentary. Remove all the scale and sediment as well as the flue dust and soot. Show the scale and sediment to the manager. Pass through the flues, and see not only that all the soot and flue dust have been removed, but that the plates have been well brushed. Also see whether the flues are damp or dry, and if damp find out the cause. Further, see that the thoroughfares in the glass water gauges and in the blow-out elbow pipes, as well as the thoroughfares and the perforations in the internal feed dispersion pipe and the scum pipes are free. Take the feed pipe and scum troughs out of the boiler if necessary to clean them thoroughly. Take the taps and the feed valves to pieces; examine, clean, and grease them, and if necessary grind them in with a little fine sand. Examine the fusible plugs. Do not put any blocks under the pipes in the hearth pit.

Preparation for Inspection.—Have the boiler cooled and carefully cleaned out as explained above. Show both scale and sediment to the inspector, as well as the old cap of the fusible plug, and tell him of any defects that may have manifested themselves in working, and of any repairs or alterations that may have been made since the last examination.

Fusible Plugs.—Keep these free from soot on the fire side, and from incrustation on the water side. Change the fusible metal once every year, at the time of preparing for annual examination.

General Keeping of Boiler.—Polish up the brass and other bright work in the fittings. Sweep up the flooring plate frequently. Keep water out of the hearth pit below the flooring plates. Keep the space on the top of the boiler free, and brush it down once or twice a week. Take a pleasure in keeping the boiler and the boiler house clean and bright, and in preventing smoke.

* Sheet of instructions to boiler attendants recently issued by the Manchester Steam Users' Association.

MECHANICAL INVENTIONS.

A device for trimming tenons of wagon and carriage wheels, and also tenons of bars composing or forming part of the framework of wagon bodies, has been patented by Mr. Andrew P. Almquist, of New Windsor, Ill. It consists, essentially, of a wooden block having a cutter pivoted thereto for trimming the spoke tenons, and suitable gauges for supporting the spokes while being trimmed.

An improvement in power looms has been patented by Mr. Polydore Dorgeval, of Paterson, N. J. The invention consists in a lay or batten constructed in two portions, one portion consisting of the shuttle rail supported on arms that are vibrated by power, the other portion consisting of the reed carried by side arms hung on a shaft, which arms are moved to beat up by a weight. The reed frame is behind the shuttle rail, so that the backward movement of the reed is given by contact of the shuttle rail; also in a cam and link connection of peculiar construction for vibrating the batten and resting the same to give time for the passage of the shuttle. Fingers are pivoted on the shuttle rail and connected with slide blocks in the shuttle boxes, for movement by the shuttle to raise and hold the weft thread taut during the movement of the batten.

An improved sand band for vehicles has been patented by Mr. Jonathan Hitchcock, of St. Paul, Minn. The construction of this device cannot be clearly described without engravings.

Mr. John Ladner, of Charlestown, Mass., has patented an improved car starter, which is so constructed that the first effort of the horses will be applied to the wheels near their rims in such a direction as will roll the wheels forward, and will be withdrawn from the wheels automatically as soon as the wheels begin to move.

Mr. Joseph Curson, of Lyons, France, has patented an improved machine for shaving wool or hair from hides, which is provided with an endless knife passing over two pulleys and through suitable guides, to the cutting edge of which the hide is fed by a series of reciprocating and oscillating claws, and is pressed down upon the cutting edge by a roller.

An improved bark mill has been patented by Mr. Dennis O'Brien, of Oswayo, Pa. The invention consists in combining a radially-slotted stationary plate provided with grinding teeth on one edge of each slot with a wheel having teeth on the under side.

Mr. Theodore Naish, of Birmingham, County of Warwick, England, has patented an improved variable feed for rock and other drills. The inventor employs two friction disks, connected respectively with a shaft and the drill, which are arranged at right angles to each other, the edge of one disk working in frictional contact with the face of the other, but made adjustable along its shaft to vary its distance from the drill, so as to vary the rapidity of motion of the driven wheel.

Messrs. Arthur L. Bigsby and Charles L. Bigsby, of Trenton, Mo., have patented an improvement in positive motion looms, in which the shuttle is operated upon and moved continuously during its entire passage across the fabric being woven. The object of these improvements is to construct a loom in which two or more shuttles or colors may be used, and such shuttles shifted at each opening of the shed or longer intervals, as may suit the pattern being woven, and to furnish a more easy and positive motion to the shuttle, accelerating and diminishing its speed without any sudden start or stop.

An improved post-hole borer, patented by Mr. Henry Landin, of Forest, O., which consists in a yoke having toes, in combination with a divided nut and slotted bench and gearing. The operator sits on the bench and operates the borer by turning the cranks.

Mr. James S. Schoonover, of Titusville, Pa., has patented a compound crank, consisting of several cranks or eccentrics arranged spirally at equal distances apart upon a central shaft so as to form a complete spiral.

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AGRICULTURAL INVENTIONS.

A simple, easily constructed machine for removing the hulls from cotton seeds and separating the hulls and kernels, has been patented by Mr. Seaborn Kitchens, Sr., of Gibson, Ga. When the seeds are hulled they are in good condition to express the oil therefrom, and they leave an oil cake free from waste, which is used for feeding animals.

Mr. Axel F. Bergqvist, of Fairfield, Iowa, has patented an improvement in sulky plows, which consists in the peculiar construction and arrangement of parts for raising and lowering the bail to which the plow is attached, and simultaneously adjusting the wheel which runs upon the land side.

An improved separator for removing cockle from grain has been patented by Mr. Eli Chapman Gage, of Whitehall, Wis. It is so constructed as to take out the cockle rapidly and thoroughly, and it is simple and convenient.

Glacier Pavements.

Speaking of the evidences of glacial action in the Sierra, Mr. John Muir, the California geologist, says that to the non-scientific observer the most striking and attractive are the polished glacier pavements, because they are so beautiful, and their beauty is of so rare a kind, so unlike any portion of the loose, earthy lowlands where people make homes and earn their bread. They are simply flat or gently undulating areas of solid granite, which present the unchanged surface upon which the ancient glaciers flowed, and are found in the most perfect condition in the sub-alpine region, at an elevation of from 8,000 to 9,000 feet. Some are miles in extent, only slightly interrupted by spots that have given way to the weather, while the best preserved portions are bright and stainless as the sky, reflecting the sunbeams like glass, and shining as if polished afresh every day, notwithstanding they have been exposed to corroding rains, dew, frost, and snow for thousands of years.

The attention of the game seeking and gold-seeking mountaineer is seldom commanded by other glacial phenomena, as moraines, however regular and artificial in form, or cañons, however deep, are strangely modeled rocks, however high and sheer; but when he comes to these bare pavements he stoops and rubs his hand admiringly on their shining surface, and tries hard to account for their mysterious smoothness and brilliancy. He may have seen the winter avalanches of snow descending in awful majesty through the woods, sweeping away the trees that stood in their way like slender weeds, but concludes that this cannot be the work of avalanches, because the scratches and fine polished striæ show that the agent, whatever it was, moved along and up over the rocks as well as downward. Neither can he see how water may possibly have been the agent, for he finds the same strange polish upon lofty, isolated tables beyond the reach of any conceivable flood. Only the winds seem capable of moving across the face of the country in the directions indicated by the scratches and grooves. Even dogs and horses, when first led up the mountains, study geology to this extent, that they gaze wonderingly at the strange brightness of the ground, and smell it, and place their feet cautiously upon it, as if afraid of falling or sinking.

The California Wine Crops.

The San Francisco *Alta* says that the California wine crop of 1880 was between ten and twelve million gallons. After mentioning the tendency of dealers to overstate the quantity of wine made, the *Alta* adds: "San Francisco has never received more than 3,500,000 gallons in a year, nor has the State ever exported more than 2,200,000 gallons in a year. The receipts at San Francisco were 1,700,000 gallons in 1876, 2,400,000 in 1877, 3,000,000 in 1878, 3,400,000 in 1879, and the same in 1880. The receipts of brandy were 60,000 gallons in 1876, 130,000 in 1877, 110,000 in 1878, and 100,000 in 1879. Our wine exports by sea were 510,000 gallons in 1876, 890,000 in 1877, 1,230,000 in 1878, 1,400,000 in 1879, and the same amount in 1880. The export by rail is about 800,000 gallons annually. The figures for 1881 will probably show a decided increase over 1880. The State has never approached the limit of its capacity in wine making, the greater part of the grapes having been used every year for the table, while many have been allowed to spoil on the vines, and the hogs have been turned into some vineyards, as the most profitable use that could be made of them. There have been years when grapes sold at Los Angeles and Sonoma for half a cent a pound at wholesale, and such low prices still prevail in large vineyards in the Sierra Nevada, remote from the market."

Traction Engines for Military Use.

An important experiment was carried out in Berlin the other day with a traction engine designed expressly for military purposes, in the presence of Field-Marshal von Moltke, General von Kamecke, the German Minister of War, General von Bülow, the Inspector-General of Artillery of the German Army, and a large number of other officers and officials of high rank. Five 15 cwt. guns, mounted on traveling carriages, with timbers complete, were attached to the engine; the whole forming a train a hundred paces long, weighing altogether 650 cwt. The gun carriages were attached to one another and to the engine by an ingenious coupling arrangement, designed to secure that the wheels of all the carriages should follow exactly in the track of the wheels of the locomotive. The invention appears to have succeeded perfectly, since the long train of carriages was taken without hitch or difficulty round very sharp corners; the traction engine and leading carriages at one point in the journey turning down a side street out of a main street before the rear carriages had entered the latter from another side street. The journey lasted for two hours and a half, the train moving with equal ease along paved streets and macadamized roads. The engine worked at a comparatively slow rate indeed; but it is said that it could have been driven at much greater speed, while it is also capable of dragging a load of 3,000 cwt.—*Continent and Swiss Times.*

The Sizes of Books.

Originally the terms *quarto, octavo,* and so on, denoting the number of foldings of the printed sheet, also designated the size of the book. But owing to the varying sizes of paper now used in bookmaking the size of a book can no longer be inferred from the number of foldings. Librarians are, therefore, adopting systems of arbitrary measurement for book sizes, retaining, however, the familiar denominations. The associated librarians of Great Britain recently fixed upon the following scale of measurements, the inferior limit of each size being the superior limit of the size below it:

Large folio..... ....la.	f°..... ... over	18	inches.
Folio.....	f°..... below	18	"
Small folio.....sm.	f°..... "	13	"
Large octavo..... .....la.	8°..... "	11	"
Octavo.....	8°..... "	9	"
Small octavo.....sm.	8° } .... "	8	"
Duodecimo.....	12° }		
Decimo-octavo	18°. ..... is	6	"
Minimo.....	m°..... below	6	"
Large quarto..... la.	4°..... "	15	"
Quarto	4°..... "	11	"
Small quarto.....sm.	4°... ..... "	8	"

To designate unusual sizes the additional terms *square* (sq.), *narrow* (na.), and *oblong* (ob.) are to be used. It would be a great convenience to book buyers if reviewers and advertisers of books could agree upon some such system.

Somatic Physics.

A suggestive paper on the applicability of the doctrine of the conservation of energy to biological studies was read at the recent Convention of Electricians at Chicago. The author, Dr. Clevenger, claimed that if any advances are to be made in these studies greater attention must be paid by physiologists to sound, heat, light, and electricity.

Tentatively the force which traverses nerve tissue may be regarded as electrical. There is no such thing as nerve force in the general acceptation. The author regards the nerves as paths of least resistance for the conveyance of force or forces existing in the universe and concerned in the life of every atom of the individual. The physical properties of foods and medicines have hardly been looked at, and the conquests of science remain to be made in the investigation of the laws of light, heat, and electricity in the production of plant and animal life. Latent and specific heats, the fluorescence of quinine and æsculin, force occlusion, and the ability of certain inorganic and organic bodies to yield up their heat, light, or electricity under appropriate conditions bear important relationship to therapeutics and physiology, and promise to make medicine a science of the most exact nature. In support the following phenomena may be cited: Light contracts the pupil of the eye as surely as electro-magnetism attracts the relay armature. Sound produces tympanic vibrations and excites muscular contractions. Heat produces general molecular changes of position throughout the body. Electricity is demonstrably held upon the large-sized nerve tissue of gymnotus and malapterurus, and nervous exhaustion follows every discharge. Electricity also produces muscular contraction. Gravitation does not lose its control of an atom for having entered into animal or plant composition. Coffee and sugar are related electrically, as zinc and platinum. Galvanometric deflections may be produced by a voltaic current generated by bitters and sweets, pungents and salts, bitters and acids. It is a rich field for investigation, bearing directly upon the problems the therapeutist seeks to understand.

Peruvian Torpedo Tricks.

In an account of the defenses of the city of Lima, a native of that city lately gave to the *World* the following account of the use of torpedoes by the Peruvians. He said:

"You recollect the destruction of their transport Loa by a torpedo concealed in a fruit boat which was turned adrift in such a way as to fall into their hands. The unloading of the fruit from what appeared to be an ordinary market boat set some clockwork in motion, and when the 300 pounds of dynamite exploded the Loa was destroyed and sunk in less than ten minutes. The corvette Covadonga was destroyed in pretty much the same way. This vessel was bombarding Chaucay, a small port about forty miles from Lima, when a small boat, 'got up' to look as if it was the gig of the captain of the port, came out to her. The corvette suspecting something wrong fired on the small boat, and its crew at once jumped overboard and swam ashore. The Chilians sent a launch after the boat. They were very cautious about it, for their Admiral has issued orders to them to keep clear of all boats adrift. Well, they passed a rope under it to see that it was really clear of any wires, had it examined by a calker to be sure that there was no false bottom, and even then were not satisfied, but had an engineer from the corvette go out and look the boat over. These doings were very closely watched from the shore, I can tell you. Finally they seemed to determine that the small boat was all right, and the launch took her in tow to the side of the corvette. They attempted to hoist her up, but as soon as the weight of the boat came on the rings at each end of her a steel rod accurately gauged to break with a certain weight snapped, and 300 pounds of dynamite stowed in the air chambers along each side of the boat exploded and in ten minutes the Covadonga was sunk. The men on shore hurried out in boats, and the launches of the corvette, which were out doing patrol duty, also helped to pick up the men in the water. Out of 160 men on board about forty were saved.

"The last attempt to use the torpedo was not successful. It took place about twenty days before I left Lima. The iron-clad Blanco Eucaleda is detailed to keep the blockade at Callao, and has an anchorage ground off the corner of the Island of San Lorenzo, which forms one side of the harbor. It was her custom to put out to sea every night to be safe from any night attacks in small boats. Every morning about 8 o'clock she returned to her buoy to anchor for the day. We arranged a sunken torpedo of two boats fastened together and sunk just under that spot. The explosive was 8,000 pounds of black powder. Clockwork was set to explode the mass at 9:30 in the morning, and at that time there was a great crowd on the shore watching the vessel, expecting to see her 'go up,' for she had come in and anchored in her old spot. But it seems that the tide, which sets very strong at that point, had carried the torpedo about half a mile away, and all we had was a very fine waterspout. Now the Blanco Eucaleda goes out to sea as usual every night, but leaves several launches to patrol the anchorage ground."

Post-mortem Examination of a Crazy Elephant.

African Jim, an elephant belonging to the St. Louis Zoological Gardens, died recently after an illness of two months. On the evening of his death he exhibited an uncontrollable desire to smash things, and endeavored to tear down the building containing the carnivora. A *post-mortem* examination was made by Dr. Charles A. Todd, who found the body somewhat emaciated.

The abdominal organs were healthy, with the exception of the liver, which was congested and showed abundant signs of old disease—inflammation. There had been an old pleurisy, or inflammation of the membrane covering the inside of the chest and surface of the lungs, which caused both lungs to be closely bound to the chest at every point, so that they were no longer freely movable, as should be the case. The lungs were also partly congested. The brain was the site of the most important pathological changes. The membranes covering it were greatly congested, and the one that lies direct in contact with the nervous substance (pia mater) was markedly thickened (showing old inflammatory disease), the blood vessels passing into it being also thickened and offering considerable resistance in the examination. Other parts of the brain were congested. The congested condition of the brain and its membranes explained the frenzy of the animal on the day of his death; this, however, was but a sudden aggravation of the long standing disease indicated by the thickened membrane and vessels, chronic meningitis, which would have insured a premature death, even if life had not been so suddenly taken off by the last attack. In human beings chronic meningitis is a disease difficult to diagnose until symptoms of paralysis, weakness of mind, marked headache, forgetfulness, appear to suggest what the ailment may be. Dr. F. R. Eversole, who assisted Dr. Todd, stated that in his experience at the City Insane Asylum he had not seen more decided evidence of brain disease of a chronic nature in the *post-mortems* there held upon the bodies of chronic cases. The elephant during life did exhibit symptoms that might have been supposed to proceed from slight headache, but his chief symptoms were failure in appetite for grain, with consequent emaciation. It should be remembered that the stomach contained an abundance of well masticated fodder, and there was no indication of disease of the intestinal tract or disturbance of its functions. The matter is one of great interest to keepers of wild animals, as this elephant evidently had been liable for some time to outbreaks of violence.

A Defense of American Pork.

The Secretary of the Treasury recently transmitted to the Senate a report on the alleged occurrence of trichinæ in American hams and other meat in Germany and elsewhere. The report was prepared under the direction of the Surgeon-General of the Marine Hospital Service, and was called out by letters received from United States consuls in foreign parts, one of which, from the Consular Agent at Mayence, states that on investigating the reports of the finding of trichinæ in American pork it was found that the infected meat was not American but German. The Senate report says that the number of diseased swine is overestimated, probably through the influence of those most interested—the German pork dealers and producers.

The One Mechanic Buried in Westminster Abbey.

Notwithstanding England's enormous indebtedness to her mechanics, but one mechanical workingman has ever been honored with a burial in Westminster Abbey; and that was Graham the clock-maker. Graham made exact astronomy possible by his great improvements in time pieces. He invented the dead-beat escapement and the gridiron compensating pendulum, and he was the first to make clocks that would run for many days without winding. Graham was also a maker of great quadrants and instruments of that sort. His funeral was attended by all the members of the Royal Society.

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Antiquity of Trade Marks.

The question has been asked somebody, "How old are trade marks?" who answers it by saying that they seem to be nearly as old as the industry of the race.

Ancient Babylon had property symbols, and the Chinese claim to have had trade marks 1,000 years before Christ. Guttenberg, the very inventor of printing, had a lawsuit about a trade mark, and he won it. As early as 1300 the English Parliament authorized trade marks, and the laws of America have always protected them. The theory by which a suit is brought for infringement of a trade mark is that its use deprives the originator of his property, and deceives the public as to the article. Extraordinary means have been required at all times to guard against the fraudulent use of marks of manufacturers.

In ancient times the greatest importance was placed upon the marks of individual workmen, because, as in the case of the armorers, valuable lives often depended on the quality of the workmanship. One old author complains that certain good and true soldiers were killed simply because the workmanship of their swords and arms was not good, and failed them when in battle. Very early, therefore, it was found necessary to make stringent laws against counterfeiting trade marks, and against scamped workmanship. Without protection in this one particular, trade would almost come to a standstill, because there are very few things, comparatively, that can be purchased upon their merits, judged at the moment. In general, we know the quality of goods by experience, and it is only after they have been in use that a certain judgment can be pronounced upon their quality. Having, then, once found that a certain workman's productions are good, we seek them again in the market. If we have no means of identifying his trade mark the whole work of buying becomes a haphazard affair. The best goods at once lose their value. This was early discovered, and probably the successors of Tubal Cain were the first to use distinctive marks on their manufactures.—*The Carpet Trade Review.*

Curious Uses and Works of Ants.

At the recent Southboro session of the Massachusetts State Board of Agriculture, Prof. E. S. Morse gave the following curious particulars about ants:

The ant belongs to a family of insects such as wasps, bees, hornets, but is the superior of them all, as are the elephant, the horse, and the dog, in other lines of animal life. Ants are constructed with the "back" bone in front, and the heart and other internal organs on the opposite side are put together upside down, as we might think. Their mouth is for biting and swallowing food only, not for breathing. Their bite is so determined and lasting that they are used in some countries for confining the edges of wounds and cuts. Ants' heads are presented to the cut surface, which they grasp with their nippers, when their bodies are cut off leaving a whole row of them to hold the flesh. They are cheaper than sticking plaster in some countries.

As an illustration of their ingenuity and intelligence, it was stated that they sometimes excavate tunnels under rivers of considerable depth and width, and use the tunnels for transporting supplies. They dig wells twenty feet deep and a foot in diameter for drinking water. The harvesting ants plant seeds on farms, which they cultivate with great skill and neatness, keeping every weed down and harvesting the grain, curing and storing it safely in weather-proof cavities in the soil. They also organize into divisions with commanders, each individual doing a certain kind of work. Some ants are smart enough for engineers, while others only know enough to do as they are told. They can count and make correct estimates of the magnitude of an undertaking, as proved by observers.

Eight chrysalides (often called the eggs of ants) were placed in a path where ants travel. A single individual found them and undertook to remove them to their home. Several were carried by the single ant patiently enough, but when twenty chrysolides were placed in the heap, another ant was found engaged in the work. The pile was increased at intervals till eighty ants engaged in the undertaking, showing that workers were detailed according to the demands of the cases.

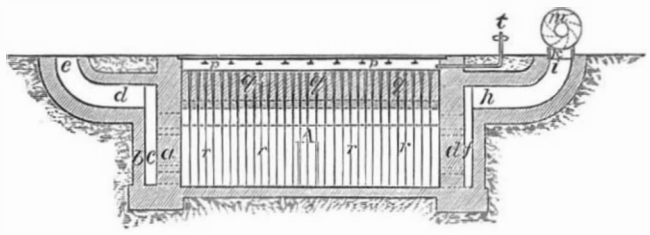
Ants' battles sometimes last many days, in one case seven weeks, the victors finally taking the stores and removing them to their own houses. Their wars are quite as justifiable as those of men, when the object—pillage—is the same. They have the power, too, of knowing members of their own communities even after six months' absence. Strangers are always driven off or killed. They are very helpful to each other, and show sympathy in case or sickness. Some families of ants build arched roads vered by an arch of clay or mortar for protection against enemies, and show great skill in the work, which is under the supervision of trained engineers, who order a rebuilding if the work is not perfect. Some kinds of ants keep cows, build cow-yards, and milk their cows regularly, and don't throw milking stools at them either to make them "give down," but pat and stroke their backs very tenderly. Of course these cows are the plant aphides so familiar to all farmers and gardeners.

A Locust-killing Beetle.

In the neighborhood of the site of ancient Troy, Sir John Lubbock finds a beetle which in both its mature and its larval condition preys upon locust eggs. The beetle is said to be very voracious. What it lives on when locust eggs are out of season does not appear. If it is not mischievous at such times, the beetle might play a good part in helping to exterminate the locusts of our Western Territories.

CELLAR FOR MANUFACTURING ICE.

From the water reservoir, *p*, which is fed by the pipe, *t*, water falls through the funnel-shaped openings, *q*, upon the threads, *r*, into the cellar, and is brought there to the freezing point soon after the exhaust fan, *m*, is set in motion. Ice can be made only when the temperature of the atmosphere is low. The air enters through the channel, *e*, *d*, *c*, and through the openings, *a*, into the cellar, A, and is drawn through similar openings, *a*, and the channel, *f*, *h*, *i*, by the exhaust fan, *m*.

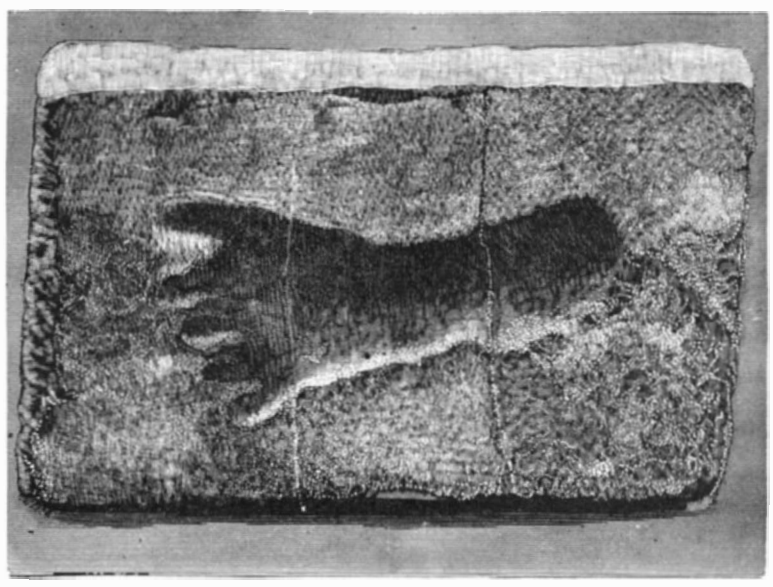


CELLAR FOR MANUFACTURING ICE.

HUMAN FOOTPRINTS IN KENTUCKY SANDSTONE.

Through the courtesy of Mr. M. Robinson, of Shawneetown, Ill., we are able to lay before the readers of the SCIENTIFIC AMERICAN a picture of what is probably the earliest human "footprint in the sands of time," that has come to the light of day.

The track from which the photograph was taken is one of three occurring in a block of sandstone in Union County, Kentucky, about a mile and a quarter from the Ohio River. The stone is very hard, and the stratum containing the tracks (or, rather, which originally contained the tracks, for they have lately been cut out) is said to be from fifteen to twenty feet thick and to lie at an angle of 21°. The buried portion underlies shale. The exposed portion would seem to have formed at one time the bank of the river, and the tracks were within a few feet of the edge of the rock. The age of the rock is uncertain. Mr. Robinson says it "is thought by those best posted here to have been below the coal measures."



HUMAN FOOTPRINTS IN KENTUCKY SANDSTONE.

The track represented in the engraving is now in the possession of Mr. Robinson. It measures ten inches in length and five inches across the spread of the toes. The foot appears to have slipped forward in making the track, thus elongating the heel mark and spreading the toes. Of the other two tracks, Mr. Robinson says that one, eleven inches long, was sent to a museum in Danville, Kentucky. It was badly defaced, but enough was left "to tell nearly all about the foot." The third track was too much defaced to be of any value, but whether in the act of cutting out, or by being weather-worn, Mr. Robinson does not say.

The tracks have been known almost from the first settlement of the county, but the former owner of the land would not let them be touched. The present owner gave Mr. Robinson permission to remove them only recently.

The geological value of these fossil footprints it is obviously impossible to estimate at this distance. It is to be hoped that the matter will be carefully investigated by some geologist so well known as to give his report assured scientific value. The ines crossing the track are cracks in the rock, which have been filled, it is inferred, by infiltration.

MISCELLANEOUS INVENTIONS.

Mr. Carl Posen, of Offenbach-on-the-Main, Germany, has patented an improved fastening for pocketbooks and other articles, which is so constructed that they may be easily and conveniently fastened and unfastened, and it presents a neat and finished appearance.

An improvement in eyeglasses has been patented by Mr. Robert Kabus, of New York city. The object of this invention is to simplify and cheapen the construction of eyeglasses and to render them more convenient for use.

An improved drop gate has been patented by Mr. James Beezley, of Rocky Ford, Col. The object of this invention is to furnish drop gates so constructed that they may be conveniently opened and closed by persons riding in a carriage or on horseback.

An improved device for securing wheels to axles has been patented by Mr. Thomas H. Outerbridge, of Hamilton, Bermuda, the object of the invention being to dispense with the screws and nuts generally used for that purpose, and to furnish a lock that shall secure the hub safely to the spindle and can be readily manipulated.

The sheets of gaff-topsails on vessels are led through sheaves at the outer end of the mainsail gaffs, and it frequently occurs that the sheets part or unbend from the sail and unreeve from the gaff, so that a man must be sent out on the gaff to reeve the sheet or the gaff and mainsail lowered to the deck for the same purpose. To lower the gaff, especially if the wind is fresh, involves considerable wear and tear on the sails and rigging, besides loss of time and labor, while the work of passing out on the gaff to reeve the sheet is the most hazardous undertaking required on vessels, as there are no footropes, beckets, or other conveniences to insure safety, and loss of life by men being thrown from the gaff is of frequent occurrence. Mr. Frank B. Cort, of Holyoke, Mass., has patented means for reeving gaff-topsail sheets, rendering such work safe and rapid. The invention consists in the combination with the gaff of an endless rope fitted to run in the throat and end sheaves of the gaff, so that the top-sail sheet can be rove from the deck or from the throat of the gaff.

Mr. Green Smith, of Coal Valley, West Virginia, has patented improvements in that class of windows designed to secure the benefits of ventilation through the entire area of the window, to permit the window-panes to be washed on both sides without taking out the sash or going outside of the window, and to secure the balancing of the sashes, the independent movement of either sash, or the entire removal of the sashes, as may be desired.

Mr. Robert B. Herskell. of Wallingford, Conn., has patented an improved apparatus to facilitate the coating of spoons, forks, and similar articles with a plating or covering of metal, so that the thickness of the plating metal shall vary at different parts of the articles, as desired, the thickness being greatest upon the parts most exposed to wear.

An improved fan, patented by Mr. Max Rubin, of New York city, relates to that class of fans on which the wing or web folds between two handles and opens into circular form when in use, and has for its object to make the fans more convenient in use and less liable to get out of order than fans constructed in the usual manner.

An improvement in steel earth scrapers has been patented by Mr. William Haslup, of Sidney, O. It consists in the means for fastening the handles to the sides of the scraper, and in curved and flanged socket plates arranged on the inner walls of the scraper to receive the ends of the backboard.

Messrs. Sylvester J. Tucker and Robert F. Williams, of Richmond, Va., have patented a street car which is convertible at will, by a simple adjustment, either into a summer or winter car.

A machine for fitting and putting together the several parts of a wagon wheel has been patented by Mr. William Casady, of Milton, Iowa. The invention consists of felly-boring, spoke-tenoning, and spoke-gauging devices combined in one machine.

Mr. George E. Bales, of Walla Walla, Washington Ter., has patented an improved snap-hook and buckle for breast-straps, hitching, and other straps or lines on which snap-hooks are commonly used. This snap-hook is more easily unsnapped and less liable to become clogged with ice or mud than those now in use.

An improved bale tie has been patented by Mr. Thomas B. Taylor, of Mount Meigs, Ala. The object of this invention is to apply bale ties and bands in such manner that the bands will not turn upon the bales when being tightened, and will be securely held, retaining the compression by preventing the bale from swelling when the pressure is withdrawn.

A block of artificial stone formed of pitch, cement, sand, and embedded surface pebbles, the latter planed down, to exhibit their various colors, has been patented by Mr. George W. Mason, of Sharon, Pa.

An improvement in machines for folding the edges of collar and cuff blanks, preparatory to sewing, has been patented by Mr. Max Hermann, of Troy, N. Y. The machine folds the blanks ready for being placed together, and attached by a single line of stitching.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

For Machinists' Tools, see Whitcomb's adv., page 28.

Two Patents for sale. R. Munroe, Fitchburg, Mass.

Best Band Saw Blades. See last week's adv., p. 28.

Cylinders, all sizes, bored out in present positions. L. B. Flanders Machine Works, Philadelphia, Pa.

The Best Arrangement of Shafting and Frictions for Communicating Power to Sewing Machines in Factories, is made by J. A. Sawyer & Son, Worcester, Mass.

Wanted—Manager for Sheet Iron Rolling Mill. State salary, references, experience. John Marshall, Kennett Square, Pa.

Hotchkiss' Mechanical Boiler Cleaner, 84 John St., N. Y.; simple, effective, inexpensive; attached to over 600 boilers, using good and bad water, doing thorough work. Engineers make ten per cent selling other parties than employers. Circulars free.

Within the last ten years greater improvements have been made in mowing machines than any other agricultural implement. It is universally acknowledged that the Eureka Mower Co., of Towanda, Pa., are manufacturing the best mower now in use, and every farmer should write to the manufacturers for catalogue, with prices.

NAVAL CONSTRUCTOR'S OFFICE,
NAVY YARD, NEW YORK, December 9, 1880.

SIR: . . . I would respectfully report that the two boilers . . . have been covered with H. W. Johns Asbestos Non-conducting Covering; the work has been done thoroughly and satisfactorily. Since the completion of the work there has been a saving of coal of about thirty per cent. (Signed), GEO. R. BRUSH. Naval Constructor.

H. W. Johns M'f'g Co., 87 Maiden Lane, New York, Manufacturers of Asbestos Paints, Roofing, Boiler Coverings, Steam Packing, Sheathing, etc.

048 Falcon Pen—the best known and most widely used in America. Ask your stationer for Esterbrook's 048 Falcon Pen.

Eureka Vegetable Boiler Scale Eradicator, strictly vegetable, and perfectly harmless to iron. Warranted to remove scale of any thickness, and to prevent scaling from either fresh or salt water use. Circulars and particulars of G. E. Brinckerhoff, 107 Liberty St., N. Y.

The Sweetland Chuck. See illus. adv., p. 12.

Moulding Machines for Foundry Use. 33 per cent saved in labor. See adv. of Reynolds & Co., page 12.

The I. B. Davis Patent Feed Pump. See adv., p. 12.

Jenkins' Patent Valves and Packing "The Standard." Jenkins Bros., Proprietors, 11 Dey St., New York.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Exporters of Machinery for Plantations. Sugar Machinery, Coffee Huller and Cleaners. Information and estimates on all classes of American machinery and patented devices. Agricultural Implements and Hardware. Jos. H. Adams & Son., 283 Pearl St., New York.

Superior Malleable Castings at moderate rates of Richard P. Pim, Wilmington, Del.

Wood-Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

The "1880" Lace Cutter by mail for 50 cts.; discount to the trade. Sterling Elliott, 262 Dover St., Boston, Mass.

The Tools, Fixtures, and Patterns of the Taunton Foundry and Machine Company for sale, by the George Place Machinery Agency, 121 Chambers St., New York.

Experts in Patent Causes and Mechanical Counsel. Park Benjamin & Bro., 50 Astor House, New York.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsb'g, Pa.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited, Erie, Pa.

Power, Foot, and Hand Presses for Metal Workers. Lowest prices. Peerless Punch & Shear Co., 52 Dey St., N.Y.

Recipes and Information on all Industrial Processes. Park Benjamin's Expert Office, 50 Astor House, N. Y.

For the best Stave, Barrel, Keg, and Hogshead Machinery, address H. A. Crossley, Cleveland, Ohio.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 40 John St., N. Y.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Downer's Cleaning and Polishing Oil for bright metals, is the oldest and best in the market. Highly recommended by the New York, Boston, and other Fire Departments throughout the country. For quickness of cleaning and luster produced it has no equal. Sample five gallon can be sent C. O. D. for $8. A. H. Downer, 17 Peck Slip, New York.

Wright's Patent Steam Engine, with automatic cut off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 412.

For Separators, Farm & Vertical Engines, see adv. p. 413.

National Institute of Steam and Mechanical Engineering, Bridgeport, Conn. Blast Furnace Construction and Management. The metallurgy of iron and steel. Practical Instruction in Steam Engineering, and a good situation when competent. Send for pamphlet.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 413.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 413.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Also manufacturers of Soloman's Parallel Vise, Taylor. Stiles & Co., Riegelsville, N.J.

The American Electric Co., Proprietors and Manufacturers of the Thomas Houston System of Electric Lighting of the Arc Style. See illus. adv., page 29.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 413.

For Patent Shapers and Planers, see ills. adv. p. 412.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Clark Rubber Wheels adv. See page 29.

Diamond Engineer, J. Dickinson, 64 Nassau St., N.Y.

Silent Injector, Blower, and Exhauster. See adv. p. 29.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien, M'f'rs, 23d St., above Race, Phila., Pa.

See Bentel, Margedant & Co.'s adv., page 29.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

50,000 Sawyers wanted. Your full address for Emerson's Hand Book of Saws (free). Over 100 illustrations and pages of valuable information. How to straighten saws, etc. Emerson, Smith & Co., Beaver Falls, Pa.

Frank's Wood Working Mach'y. See illus. adv., p. 30.

Elevators, Freight and Passenger, Shafting, Pulleys and Hangers. L. S. Graves & Son, Rochester, N. Y.

Blake's Belt Studs. The strongest fastening for Rubber and Leather Belts. Greene, Tweed & Co., New York.

Eclipse Portable Engine. See illustrated adv., p. 30.

Peerless Colors—For coloring mortar. French, Richards & Co., 410 Callowhill St., Philadelphia, Pa.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 29.

Cotton Belting for Elevators; Carrying and Driving Belts. Greene, Tweed & Co., 118 Chambers St., N. York.

Rollstone Mac. Co.'s Wood Working Mach'y ad. p. 29.

For Heavy Punches, etc., see illustrated advertisement of Hilles & Jones, on page 29.

Comb'd Punch & Shears; Universal Lathe Chucks. Lambertville Iron Works, Lambertville, N. J. See ad. p. 413.

Reed's Sectional Covering for steam surfaces; any one can apply it; can be removed and replaced without injury. J. A. Locke, Agt., 32 Cortlandt St., N. Y.

Pays well on small investments.—Magic Lanterns and Stereopticons of all kinds and prices. Views illustrating every subject for public exhibitions and parlor entertainments. Send stamp for 116 page catalogue to McAllister, M'f'g Optician, 49 Nassau St., New York.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher, Schumm & Co., Philadelphia, Pa. Send for circular.

Penfield (Pulley) Blocks, Lockport, N.Y. See ad. p. 29.

Tyson Vase Engine, small motor, 1-33 H. P.; efficient and non-explosive; price $50. See illus. adv., page 28.

Use Vacuum Oil Co.'s Lubricating Oil, Rochester, N.Y.

Wiley & Russell M'f'g Co. See adv., p. 412.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) H., referring to the reply to A. R., December 18, writes: Here is a plan for removing foreign substances from the eye, which has given relief in a number of cases not only from cinders but other substances. Holding the eyelash, draw the upper lid down as far as possible over the lower lid. In nine out of ten cases the lower eyelash will brush off the cinder.

(2) W. R. S. asks: 1. Will it require more fuel to evaporate a certain quantity of cane juice by steam than by heat applied directly to the bottom of the evaporator? A. No. 2. Would evaporating by steam make a lighter sirup than and be preferable to heat applied directly to the evaporator? A. It would, unless great care were used in direct firing under the kettles. 3. What should be the heating surface of a boiler to insure the evaporation of two hundred and fifty gallons of cane juice to a dense sirup in one hour? How high a pressure would be required to secure rapid evaporation? What form of boiler would be best adapted to this purpose? A. 750 to 800 feet heating surface; the higher the pressure the more rapid the evaporation. Any good boiler will answer, but if you use a tubular boiler, increase the heating surface 20 per cent. 4. What size steam pipe should be used? A. Two and a half to three inches diameter.

(3) J. C. R. writes: I see an inquiry about cutting screws with foot lathe slide rest (No. 11 in Notes and Queries, SCIENTIFIC AMERICAN, No. 25), and would say that I have had my slide rest arranged for this purpose for years. The screw of slide rest projects beyond the bed plate of the rest about one inch, and is supported by a bearing screwed to the bottom plate of slide rest. A brass plug is screwed over end of screw; one end carries a gear, while the other end runs in bearing. There is a wheel on mandrel, which runs wheel on end of slide rest screw to cut right hand thread; to cut left hand screw I use an intermediate wheel. The slide rest bed is fourteen inches long, if the screw to be cut is too long or far off for the wheel on the screw of the rest I put it on a hollow shaft attached to the lathe so as to be turned by wheel on mandrel. I pass a rod through the hollow shaft and connect one end of it with the slide rest screw so as to be firm, then it is fastened in the hollow shaft by a binding screw, so as to revolve.

(4) W. A. writes: 1. I want to know the simplest accurate way to find the horse power of a boiler. A. From twelve to eighteen square feet of heating surface is allowed per horse power, the larger proportion for tubular boilers. 2. Manufacturers generally give the size of boiler, flues, and fire box. Do you allow the same number of square feet to horse power for grate as flue surface? A. The grate surface should be equal to one-twenty-sixth to one-thirtieth the heating surface. 3. Does dividing the square of the diameter of the cylinder by four give you the horse power of an engine? If not, how do you find it out? A. We refer you to SUPPLEMENT, No. 253, for rule for calculating power of steam engines.

(5) Rev. A. R. H. asks whether it would be profitable to establish, in connection with one of the creameries, a manufactory of milk sugar, provided the whey could be bought in quantities of 6,000 quarts daily, at a half cent a quart. A. We see no reason why, with good management, the industry should not prove profitable under such favorable circumstances. If properly conducted you can obtain nearly 3 per cent of refined sugar, which will bring at least 35 cents a pound.

(6) J. R. H. says: I would like to know the kind of machinery used for making oil from cotton seed and the manner in which it is done, the cost of fixture, and the amount of oil per bushel of seed. A. The seed is passed through a hulling machine, usually consisting in a set of rollers geared so that the surface of one travels faster then the other. This crushes the seed and loosens the hull, which is separated by sieves. The decorticated seed is then ground in a mill, then submitted to hydraulic pressure. Before pressing the meal it is usually heated in a steam jacketed vessel provided with a mechanical stirrer, to facilitate the expressing of the oil. According to Sims' process the oil is extracted from the meal by liquid solvents, bisulphide of carbon, or hydrocarbon oils; 56 lb. hulled seed yield about 2 galls. oil. The huller, mill, and press are the principal pieces of machinery required. Address the dealers who advertise in our columns.

(7) J. T. McC.—Brass work may be brightened with a little oxalic acid dissolved in water and applied with a cloth or brush.

(8) M. Y. D. asks how vanilla bean must be prepared for flavoring ice cream. A. Macerate the pulped bean and percolate with alcohol; dilute the strong extract with water, and filter, if necessary, through white paper.

(9) C. R. M. and others ask how to engrave glass by means of the sand blast? A. Sand driven by an air blast of the pressure of four inches of water will completely grind or depolish the surface of glass in ten seconds. If the glass is covered by a stencil of paper or lace, or by a design drawn in any tough elastic substance, such as half dried oil, paint, or gum, a picture will be engraved on the surface. Photographic copies in bichromated gelatin from delicate line engravings have been thus faithfully reproduced on glass. In photographic pictures in gelatin, taken from nature, the lights and shadows produce films of gelatin of different degrees of thickness. A carefully regulated sand blast will act upon the glass beneath these films more or less powerfully, in proportion to the thickness of the films, and the gradations of light and shade are thus produced on the glass. In the apparatus used air rises through a curved tube, carrying the sand up with it, which is thrown into the air tube by an endless belt of scoops arranged in the lower part of the angular box. The sand is carried up by the air and brought over and down the front air tube, where it discharges with great force upon the surface of the glass, which is contained within the front box and is carried by a belt gradually forward under the blast.

(10) R. A. C. asks how to prepare wax for waxing floors. A. Two oz. of pearlash, 16 oz. of wax, and about half a pint of water are heated to boiling in a dish, which is frequently agitated, until a thick fluid mass is formed, from which, upon removal from the fire, no watery liquid separates. Boiling water is now cautiously added to the mass, until no watery drops are distinguishable. The dish is again set on the fire, but its contents are not allowed to boil (otherwise myricin would separate out), eight or nine pints of water being added, little by little, with constant stirring. Coloring matter may be added if desired.

(11) A. V. asks how to harden thin steel plates, so as to avoid springing and cracks. A. Fill the holes with fire clay and wire to keep it in place. Heat evenly and slowly in a furnace. Lift the dies from a furnace with the face vertical, and plunge vertically into water heated to about 50° and containing about a half pound salt per gallon. Hold them still at the bottom of the water until cooled.

English Patents Issued to Americans.

From December 10 to December 14, 1880, inclusive.

Brake, G. Westinghouse, Jr., Pittsburg, Pa.
Electric drill, C. E. Ball, Philadelphia.
Furnace and boiler for heating purposes, S. W. Underhill, Croton Landing, N. Y.
Gas regulator, H. Barlow, New York city.
Hoisting apparatus, F. G. Johnson, Brooklyn, N. Y.
Horn blowing apparatus, W. B. Barker, Hoboken, N. J.
Horseshoe nail machine, A. Coleman, Providence, R. I.
Lamp, W. B. Robins, Cincinnati, Ohio.
Mould forming apparatus, S. J. Adams, Pittsburg, Pa.
Ore crusher, F. A. Luckenbach *et al.*, New York city.
Railway vehicles, J. W. Chisholm, Brooklyn, N. Y.
Shaft coupling, T. R. Almond, New York city.
Sweat band, T. W. Bracher, New York city.
Telegraph, H. Van Hoevenburgh, New York city.
Telegraphy, S. L. M. Barlow, New York city.
Telephone, S. L. M. Barlow, New York city.
Telephone, T. A. Edison, Menlo Park, N. J.
Vegetable fibers, preparation of, J. G. Stephens, Jersey City, N. J.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

December 14, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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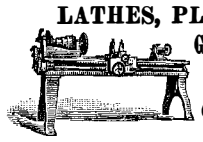

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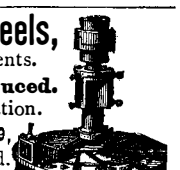

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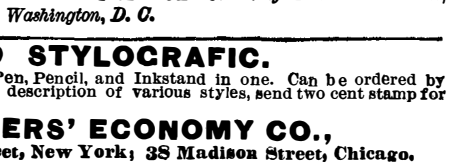

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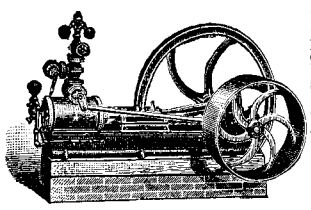

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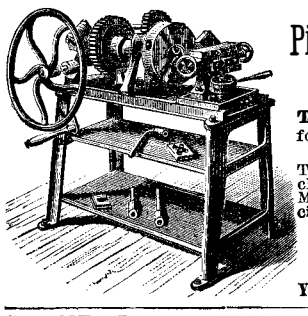

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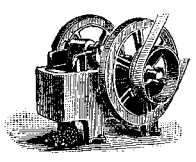

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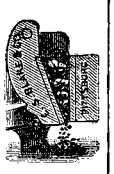

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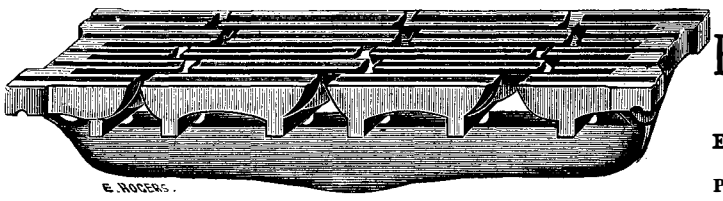

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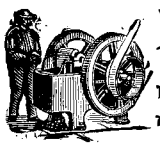

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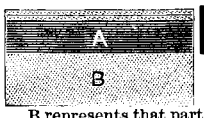

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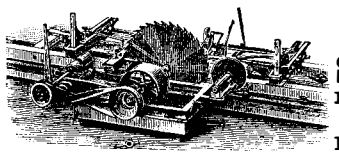

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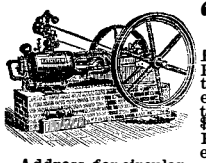

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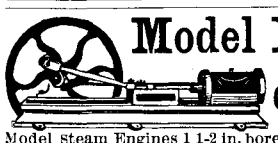

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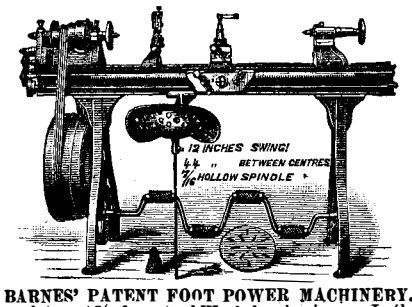

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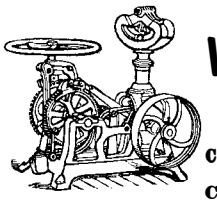

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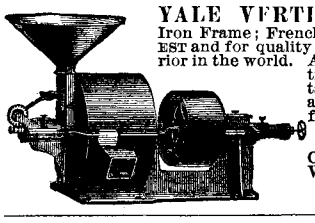

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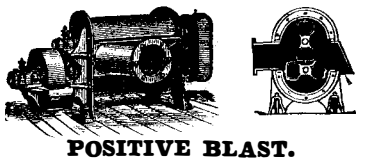

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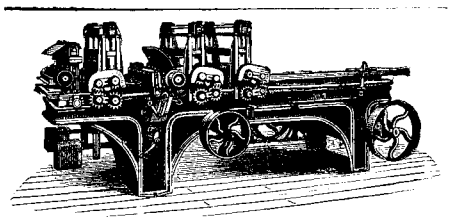

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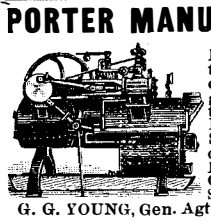

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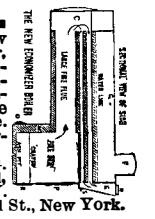

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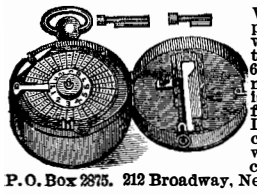

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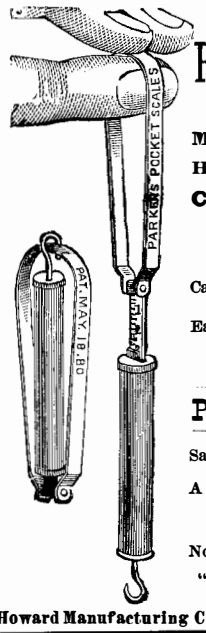

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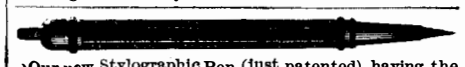

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